Construction Site
Storm Water Quality Sampling
Guidance Manual

December 2003

State of California
Department of Transportation

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Section 1 Introduction

1.1 Purpose of Document

This manual presents guidance for Department management, staff, and Contractors to use in the planning and implementation of storm water monitoring programs conducted at construction sites in order to comply with the following regulatory requirements:

- *National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California Department of Transportation (Caltrans)*, Order No. 99-06-DWQ, NPDES No. CAS000003, Sections H, J.1, and J.2

- *National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity*, herein called the "General Permit", Sections B.7 and B.8

- Department's Statewide Storm Water Management Plan (SWMP), Section 6.2

The manual is designed and organized to provide descriptions of the processes used to plan and implement a successful water quality monitoring program specific to runoff from construction sites. The manual is specifically prepared to address the monitoring of storm water runoff from construction sites, and provide supporting information for the sampling requirements of the General Permit.

The main objective of this manual is to provide consistency in monitoring methods among the Department's various construction sites, as well as consistency in monitoring protocols over time. Such consistency is essential to provide for data comparability, and for ease of data entry in the Department's storm water database. In addition to consistency of monitoring methods, it is essential that monitoring data be collected so as to ensure that the data are accurate and precise. This manual therefore features detailed information on quality assurance and quality control procedures.

The sampling requirements and guidance provided in this manual will apply to most construction projects, but may not apply to all construction projects. It is the responsibility of each construction site Resident Engineer (RE) and Contractor's Water Pollution Control Manager (WPCM) to evaluate their construction project and develop a site-specific sampling and analysis strategy in compliance with the General Permit and Storm Water Pollution Prevention Plan's (SWPPP's) requirements. For further guidance and/or direction about what must be accomplished to comply with the General Permit, the District Construction Storm Water Coordinator or the local Regional Water Quality Control Board (RWQCB) can be contacted.

The sampling requirements discussed in this manual are intended to supplement the visual monitoring program previously required by the General Permit. All construction projects must continue the visual monitoring program that requires inspections before predicted rain events, during extended rain events, and following actual rain events that produce runoff.

1.2 Background

The California State Water Resources Control Board (SWRCB) reissued the General Permit for Storm Water discharges Associated with Construction Activities (General Permit) in 1999. Several non-government organizations filed a court petition challenging the General Permit. In 2000, the Court issued a judgment and directed the SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether Best Management Practices (BMPs) implemented on a construction site are (SWQTF 2001):

(1) Preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired (Clean Water Act Section 303(d) List) for sedimentation, siltation, or turbidity; and

(2) Preventing other pollutants, known or should be known by permittees to occur on construction sites and that can not be visually observed or detected in storm water discharges, from causing or contributing to exceedances of water quality objectives.

The monitoring, sampling and analysis provisions in the General Permit were modified in 2001 pursuant to the court order and were issued as Resolution No. 2001-046. The Department adopted the new provisions and included them in the Standard Special Provisions (SSP) Section 10.1.

1.2.1 Impaired Water Bodies for Sedimentation/Siltation or Turbidity

Certain lakes, streams, rivers, creeks and other bodies of water in California have been determined by RWQCBs to be impaired for sedimentation, siltation, or turbidity. Discharges of storm water from construction sites into a 303(d) listed body of water is not prohibited as long as the type and level of pollutant(s) does not cause or contribute to an exceedance in the current levels of sedimentation, siltation, and or turbidity.

1.2.2 Non-Visible Pollutants

RWQCBs have established “designated uses” for most lakes, streams, rivers, creeks and other bodies of water in California. These uses apply to navigation, water supplies, recreation, and habitat. Associated with these uses are “water quality objectives.” These objectives identify the level of water quality required or degree of impact that can be imposed without preventing or negatively impacting the designated use.

Discharges of storm water from construction sites into a 303(d) listed body of water is not prohibited as long as the type and level of pollutant(s) does not cause or contribute to an exceedance in the specific water quality objectives of the receiving water. The presence of non-visible pollutants on construction sites is known or should be known by the RE and WPCM.

1.3 Purpose of Sampling

The Contractor is required to implement specific sampling and analytical procedures. These procedures will determine whether the BMPs employed on a construction site are effective in controlling potential construction site pollutants from leaving the site and causing or contributing to an exceedance of water quality objectives in the receiving waters. The mode of transportation of pollutants is often storm water. The results of the sampling are evaluated to determine whether BMPs implemented on the construction site are:

- Preventing further impairment by sediment in storm waters discharged into water bodies listed as impaired due to sedimentation, siltation or turbidity.

- Preventing pollutants that are not visually detectable in storm water discharges, to cause or contribute to exceedances of water quality objectives

Sampling and analysis for non-visible pollutants is required only when construction materials that could pollute runoff are exposed to rain and runoff (SWQTF 2001). The presence of a material on the construction site does not mean that dischargers must automatically sample for it in runoff. The Contractor can limit the amount of sampling and analysis they perform by limiting the exposure of construction materials to rain and storm water runoff. Materials that are not exposed do not have the potential to enter storm water runoff, and therefore do not need to be sampled in runoff. In cases where construction materials are exposed to rain water but the rain water that contacts them is contained, then sampling only needs to occur when inspections shows the containment failed. Many common BMPs already limit exposure to most materials. Improving these practices to prevent exposure is a better approach to preventing pollution of runoff and will limit the amount of sampling and analysis. Improved BMPs are likely to be less costly than an on-going sampling and analysis program.

1.4 Organization of the Manual

This manual is organized to assist the Department management, staff, and Contractors through the process necessary to develop a sampling and analysis strategy in compliance with the SSP and General Permit.

Section 2 provides information on developing a sampling and analysis strategy for sediment, silt and turbidity.

Section 3 provides information on developing a sampling and analysis strategy for non-visible pollutant sampling and analysis, including what to sample for in construction storm water runoff.

Section 4 provides two model sampling and analysis plans (SAPs) as defined in the document, *SWPPP/WPCP Preparation Manual (2003)*, for sediment/silt and non-visible pollutants.

Section 5 provides other sources to obtain more information.

Section 6 provides a glossary of terms used throughout the manual.

Section 7 provides a list of references used in the preparation of this manual.

Section 2
Monitoring Program for Sediment/ Siltation/Turbidity

2.1 Permit Requirements/SSPs

The standard requirements for monitoring sediment/silt or turbidity at Department construction sites are presented in Special Provisions (SSP) Section 10.1, Sampling and Analytical Requirements. These requirements are based on the requirements listed in both the Department's NPDES Storm Water Permit, and the Statewide General Permit for Construction Sites. According to Section 10.1:

> "The contractor is required to implement specific sampling and analytical procedures to determine whether BMPs implemented on the construction site are….preventing further impairment by sediment in storm waters discharged into water bodies listed as impaired due to sedimentation, siltation or turbidity."

Sampling and analysis for sediment/silt or turbidity are only required when the runoff from a construction site <u>discharges directly</u> into a water body that has all ready been identified by the State of California as being impaired by sedimentation, siltation or turbidity. Water bodies impaired by sedimentation, siltation, or turbidity in California are identified on the state's 303(d) list published by the SWRCB. The 303(d) list of water bodies impaired by sedimentation, siltation and or turbidity are listed in Appendix A. Sampling is not required for water bodies that are not included on the 303(d) list for one of these impairments.

Another key point in the SSP and Permits is that the sampling and analysis for sediment, silt and or turbidity are only performed for discharges of runoff from a construction site that <u>directly enter</u> the impaired water body. Storm water runoff from the construction site is not considered a direct discharge to a 303(d) listed water body if it first flows through:

(1) A municipal separate storm sewer system (MS4)

(2) A separate storm water conveyance system where there is co-mingling of site storm water with off-site sources

(3) A tributary or segment of a water body that is not listed on the 303d list before reaching the 303d listed water body or segment

Even if the flow eventually enters an impaired water body, construction site runoff is not considered a direct discharge if it first flows through a tributary or municipal storm drainage system (General Construction NPDES Permit Section B7, 6th sentence).

At Department facilities, the potential for runoff to directly enter a water body is the greatest at bridge crossings or where the road is located in close proximity to a water body such as along the shoreline of a lake or bay, or the stream bank of a river.

Sampling will not be required at construction sites that do not directly discharge to impair water bodies. Sampling is also not required if all runoff is contained on-site and allowed to infiltrate or evaporate.

If sampling and analysis will be performed at a specific site for sediment/silt and or turbidity, a sampling strategy needs to be formulated. The basis of the strategy will involve:

- The locations where sources from the construction site discharge directly into the 303(d) listed water body, and the locations of run-on to the project with the potential to combine with runoff that discharges directly from the construction site.
- The sampling schedule that specifies water quality samples will be collected during the first two hours of discharge from rain events during daylight hours (sunrise to sunset), and shall be collected regardless of the time of year, status of the construction site, or day of the week.
- The sampling locations for collecting water quality samples and the rationale for their selection.
- A list of analytical parameters associated with sediment/silt (total suspended solids, settleable solids, suspended sediment concentration) or turbidity.

2.2 Designing a Sampling Strategy

The SSP, along with the General Permits, identify specific requirements that must be included in any sampling and analysis program for sediment/silt and or turbidity. The incorporation of these requirements into an overall sampling strategy will be discussed in this section. The contractor must include in the SWPPP a sampling and analysis plan (SAP) for sedimentation/silt and or turbidity monitoring if required by the project SSP.

2.2.1 Sampling and Analysis Plan (SAP)

The purpose of the SAP is to provide standard procedures to be followed every time a sample is collected and analyzed, and the results evaluated. Following the plan maximizes the quality and usefulness of the data.

The SAP shall be prepared in conformance with protocols and guidelines discussed in this document and the Department's Guidance Manual: Stormwater Monitoring Protocols (Caltrans July 2000). The Guidance Manual is available on the Department's Internet site http://www.dot.ca.gov/hq/env/stormwater/special/index.htm. Properly trained staff in field water quality sampling procedures, laboratory analytical methods, and data validation procedures should prepare the SAP. The analytical laboratory should provide input to ensure that the SAP (especially the QA/QC portion) is realistic, and consistent with the laboratory's operating procedures. Sampling personnel should also provide input regarding logistical details to maximize the practicality and usefulness of a SAP.

The SAP should include a thorough description of all activities required to implement the monitoring program. The plan should be organized to provide an overview of the project goals and organization, followed by a description of all monitoring activities in the chronological sequence in which they will typically occur. That is, pre-monitoring preparations should be described, followed by activities to be undertaken during storm events, followed by post-storm activities. The plan should specify the quality assurance/quality control protocols that will be followed by sampling and laboratory personnel, and how the field and laboratory results will be managed and reported.

A standard template to be used when preparing a SAP for monitoring sediment/ silt and or turbidity at all Department construction sites is presented in Section 600.4, Sampling and Analysis Plan for Sediment, in the SWPPP/WPCP Preparation Manual (Caltrans March 2003). Section 600.4 can be found in Appendix B.

The required SAP for Sediment, as it is referred to in Section 600.4, will contain the following sections:

- Scope of Monitoring Activities
- Monitoring Strategy (including sampling schedule and locations)
- Monitoring Preparation
- Sample Collection and Handling (including collection procedures, handling procedures, documentation procedures)
- Sample Analysis
- Quality Assurance / Quality Control
- Data Management and Reporting
- Data Evaluation
- Change of Conditions

Standard language, required site-specific information, and instructions for completing this SAP are provided in Section 600.4.

2.2.2 Is Sampling Required?

The first step in developing a strategy is to determine if sampling is necessary. The following question needs to be answered:

> **Is the construction site adjacent to a water body listed on the 303(d) list for impairment due to sedimentation/silt or turbidity?**

The construction site should be located on a map that shows all water bodies along with their names, such as a USGS quad. Any water body located within the vicinity of the construction site should be noted. These names should be checked against the current list of the 303(d) water bodies that are impaired from sedimentation/silt or turbidity located in Appendix A. All matches should be noted. Maps have been developed by the various RWQCBs that highlight the water bodies or portions of water bodies included on the 303(d) list. These maps for water bodies listed for sedimentation/siltation or turbidity are also included in Appendix A. For some of the larger or longer water bodies, only a portion (e.g. stretch of river) may be listed. Make certain the portion located in the vicinity of the construction site is identified on the 303(d) list. A GIS-program has been provided to define the coordinates at specific points on the RWQCB maps of 303(d) listed water bodies.

Department construction sites are considered “adjacent” to a water body if any portion of the construction area crosses over the water body or the area shares a border with a stream bank or shoreline and storm water runoff will enter the waterway. For each identified 303(d) water body in the vicinity of the construction area, the proximity of the construction area needs to be checked. If the proposed construction area is close to 303(d) listed water body, such as within 50 meters (150 feet), an assessment should be made concerning the possibility of runoff from the area reaching the water body and if sampling will be required.

Finally, determine if the runoff from the construction site is first directed to either a municipal storm drain or a tributary prior to discharging into the impaired water body. In urban areas, it is common for the runoff to be directed to the municipal drainage system. In rural areas, runoff is commonly directed to the nearest natural drainage channels. However, the nearest natural drainage channel may be the 303(d) listed water body.

If the construction site is found to be adjacent to a 303(d) listed water body and runoff from the site may directly discharge to the water body, than a sampling strategy will need to be developed because the site has the potential for causing a negative impact to the water body as defined in the General Permits. Sampling will not have to be performed nor a sampling strategy developed if the construction site is not near a listed water body, a significant distance away, or first directs the runoff to a municipal or tributary drainage system.

2.2.3 Data Requirements

Sediment or Silt. If the water body is listed as impaired for sedimentation or siltation, water samples are to be analyzed for several parameters as listed in Table 600.1 of the SWPPP/WPCP Preparation Manual (March 2003). One option is to analyze the samples for settable solids (SS) and total suspended solids (TSS). A second option is to analyze the samples just for the suspended sediment concentration (SSC). The USGS considers SSC to be a more accurate and representative measurement of suspended sediment than TSS (USGS 2000). However, commercial laboratories often do not offer SSC analyses.

The use of either TSS or SSC, or both is acceptable for suspended solids analysis. It is important that the same method be used to analyze all samples. Costs for TSS, SSC, and SS typically range from $10 to $25 per sample.

Turbidity. If the water body is listed as impaired for turbidity, samples are analyzed for the level of turbidity. Samples can be collected and sent to a laboratory for analysis. The cost is typically $10-$15 per sample. Or the turbidity can be measured in the field using any number of the commercially produced turbidity meters. The use of the turbidity meter will provide instantaneous results as oppose to having to wait a number of days for results to come back from the laboratory. If turbidity is the only required parameter and no other sampling is being performed, a turbidity meter may be the method of choice.

Once again, the measurement method should be consistent during each sampling event to maximize the comparability of the various samples. Samples analyzed by different methods cannot be easily compared.

A State-certified laboratory is required to perform the analyses in conformance with the EPA requirements listed in 40 CFR 136. A list of State-certified laboratories that are approved by the Department is available at the following Internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

2.2.4 Where to Sample

The SSP requires sampling to be performed at the following locations at the construction site:

(1) Instream in the 303(d) water body, downstream from the last point of direct discharge from the construction site

(2) Instream in the 303(d) water body, upstream of direct discharges from the construction site

(3) Immediately down gradient of run-on point(s) to the construction site

The upstream location is required to establish the water quality of the water body prior to coming in contact with the discharges from the construction site. The downstream location is required to establish the water quality of the water body after coming in contact with the discharges. The run-on location is required to establish the water qualify of runoff coming on to the construction site prior to commingling with runoff from the site. This run-on runoff may be a source of sediment, silt, and turbidity.

Upstream and downstream sampling may take place on a variety of water bodies, including rivers and creeks, lakes, or tidally-influenced bays, estuaries, and sloughs. Each type of water body will have a unique pair of upstream/downstream sampling points.

Rivers and Creeks. Establishing upstream and downstream on rivers and creeks is relatively straightforward because the flow is always in the same direction. The upstream sampling location should be established at a point along the bank that is upstream all possible direct discharge points from the construction site. The actual samples should be collected in or near as possible to the main current. If the discharge creates a visible plume in the river or creek, avoid collecting a sample near this plume. However, the water quality of the river or creek may be impacted from sources further upstream during rain events and sampling crews need to be prepared to change sampling points so the most representative sample is collected. Further details of this sampling process are presented in Section 2.3.3.

The downstream sampling location should be established along the bank downstream all direct discharge points from the construction site. If possible, the location should be far enough downstream so the discharge(s) has mixed with the upstream flows. Avoid establishing the sampling location near the point of discharge or in the initial zone of dilution (within 5 meters or 20 feet). Establishing the sampling point at least 15 meters (50 feet) downstream from the discharge is a good general rule.

Be prepared to change locations for each event. The actual downstream sampling location will depend on the size of the plume and most likely vary for each event. The size of the plume will depend on the upstream flow rate and associated sediment load and the discharge flow rate and associated sediment load. Further details of the sample collection process are presented in Section 2.3.3.

Lakes. Establishing upstream and downstream stations along lakes will be a challenge because there is no consistent flow direction. Wind direction usually dictates the direction of flow. Sampling personnel should expect to identify both the upstream and downstream locations during each individual sampling event.

The upstream sampling location should be established well away from any discharge point. Wave action may stir up sediments near the shore so samples should be collected out from the shore and away from any visual plume.

The downstream sampling location should be established based on the direction the plume travels. The actual sample should be collected at the point where the plume has mixed with the surrounding water. The sample should be collected before the plume commingles with another discharge or with sediment stirred up by the action of waves. If the plume heads out from shore, sampling may have to be performed from a boat.

Bays, Estuaries, and Sloughs. Establishing upstream and downstream stations along bays, estuaries, and sloughs will be similar to lakes except the flow direction is dictated by tides and or wind. The direction of the flow will probably change throughout the day as the tide flows in and out. Sampling personnel should consult daily tide charts to know whether the tide is coming in or going out. Upstream and downstream locations will depend on the flow patterns at the time sampling takes place.

The upstream sampling location should be established at a point along the shore that is upstream all possible direct discharge points from the construction site. Wave or tidal action may stir up sediments near the shore so samples should be collected out from the shore and away from any other visual plume.

The downstream sampling location should be established based on the direction the plume travels. The actual sample should be collected at the point where the discharge has mixed with the surrounding water. The sample should be collected before the plume commingles with either another discharge or sediment stirred up by the action of waves. If the plume heads out from shore, sampling may have to be performed from a boat.

Run-on Points. The up gradient boundary of the construction site should be inspected for evidence of runoff coming on to the site from outside areas. Existing drainage channels (large and small) should be noted and marked in the field and on site maps. All these channels are potential points to collect samples of runoff from outside sources. Only runoff that is concentrated can be sampled. Run-on may enter as overland sheet flow, which will require the use of sand bags to concentrate the flow.

In general, each potential sampling station should be visited to confirm the expected site characteristics and verify whether the site is suitable for the needs of the program. When possible, a visit should be conducted during a storm, when the instream flow conditions can be observed. A wet-weather visit can provide valuable information regarding logistical constraints that may not be readily apparent during dry weather. However, a dry weather visit should also be conducted to observe any non-storm water flows. A number of potential sampling locations will have to be identified at constructions sites along lakes, bays, estuaries, and sloughs since the actual direction of the flow will not be known until the time of the discharge.

Information to gather during a site visit may include whether an appropriate sampling location exists, potential safety issues, and site access. In addition, it is useful to identify potential contributions of runoff from adjacent areas and instream conditions such as other point sources, backwater effects, tidal or wind influences, and poorly mixed flows.

Sampling locations shall be shown on the SWPPP Water Pollution Control Drawings (WPCDs). GPS coordinates or post miles can be used to define locations. A unique number should be selected for each construction site by which samples can be identified.

2.2.5 When to Sample

The SSP requires that:

- Water quality samples shall be collected at each sampling locations during the first two hours of a discharge.
- Sampling will only be performed during daylight hours (sunrise to sunset).
- Samples shall be collected regardless of the time of year, status of the construction site, or day of the week.
- A minimum of 72 hours of dry weather shall occur between rain events to distinguish separate rain events.
- No more than four discharge events need to be sampled per month.

Based on these criteria, sampling will only be performed if the discharges begin during daylight hours. No sampling is required if the discharges start during the night, even if the discharge continues into daylight hours.

Discharges to the water body can occur anytime during a rain event. Runoff may not occur for some time after the start of the rain. Therefore, the site will need to be monitored throughout each day when rain is falling.

An attempt shall be made to collect samples that are representative of upstream and downstream water quality as defined by the following considerations:

- Suspended solids and turbidity levels are highly variable in water bodies, especially during wet-weather events. Collecting a single sample at the upstream and downstream sites during a discharge event may not provide a set of samples that represent the typical conditions at either location.
- To overcome this variability, a series of five (5) samples shall be collected at the downstream and upstream stations sometime during the first two hours of discharge.
- The interval between the five (5) samples can vary. If the distance between the upstream and downstream stations is short enough to walk, the sample interval can be extended over a longer period (i.e., taking a sample every 10 to 15 minutes).

If the distance is far enough so the sampling station will only be visited once during the two-hour period, then the five samples will need to be collected over a short period, say five to ten minutes.

- One (1) sample shall be collected at each of the run-on sites sometime during the first two hours of discharge.

- All samples are sent to the laboratory for analysis. The laboratory shall be given instructions to combine all the individual samples from a given site into a single sample. This combined or composite sample is then analyzed and a single result is provided for each site.

- Multiple field measurements collected at a single station (upstream, downstream, or run-on) for a given event will need to be averaged and a single value reported.

2.2.6 Sampling Methods and Equipment

Manual grab sampling techniques will be used to collected samples for TSS, SS, SSC, or turbidity. A grab sample is an individual sample collected at one specific site at one point in time. Analysis of a grab sample provides a "snapshot" of the quality.

Grab samples are most often collected using manual methods as opposed to using automatic sampling equipment. Water samples for both the sediment/silt and turbidity monitoring will be collected manually into sample bottles or, in the case of turbidity, possibly measured directly in the water body with an electronic meter. Manual sampling entails a person reaching into the flow stream and either collecting a sample of the flow into a container or taking a measurement with an electronic device.

Manual sampling equipment is designed to collect the required sample volume from the flow stream. The equipment includes bottles or intermediate containers to collect the sample. Intermediate containers are used to collect a larger sample volume and then immediately distribute this sample to individual bottles. A grab pole is often employed as a means to extend the sample bottle or container out or down into the flow stream. The pole is designed so the sample bottle or container can be attached to the end. Using a pole avoids having to wade into a stream.

For all collection efforts, water-sampling devices must be made of chemical resistant materials that will not affect the quality of the sample. For sediment/silt or turbidity, the possible materials include high-density polyethylene plastic, glass, and stainless steel. All three are known to be inert in terms of adsorption or desorption of inorganic compounds such as sediment. Polyethylene is preferred over glass and stainless steel because of its durability, resistance to breakage, and lightweight. Stainless steel is often used for intermediate containers. It is important to evaluate each component used to collect a sample for possible sources of sample contamination including bottle lids and protective gloves.

Electronic equipment is available for certain field-measured analytical parameters including turbidity. The electronic equipment provides instantaneous results, which reduces the time between sampling and analysis.

Turbidity meters come with either a probe that is directly immersed into the sample, or a small grab sample is manually collected using a standard container that is then placed in the meter for analysis. Intermediate containers can be used to collect a sample. The probe can be immersed into the container. Turbidity meters range in price from $700 to over a $1000. However, it is important to realize the limitations associated with the use of electronic equipment:

- The equipment may not provide low enough detection limits to meet the specific reporting limits
- The meter needs to be calibrated prior to each event to maximize its accuracy
- Assuring the quality and reliability of the results may be difficult
- This equipment is sometime susceptible to fouling and clogging
- Turbidity meters that use a probe may require substantial flow for accurate readings

2.2.7 Data Analysis and Interpretation Methodology

Results from the upstream and downstream stations need to be compared to one another for each event. The downstream water quality sample analytical results will be evaluated to determine if the downstream sample(s) show elevated levels of the tested constituent relative to the levels found in the upstream sample (SWPPP/WPCP Preparation Manual 2003). This comparison will indicate whether a net increase of sediment, silt, or turbidity has occurred to the receiving water body as a result of runoff discharges from the construction site. If the data from the downstream station has higher values than the upstream station, the runoff from the construction site may be impacting the water body. The comparison will look at the percent difference for all tested parameters.

The result from any run-on samples and the required visual inspections performed before, during and after events, should provide the information needed to identify the cause(s) and or source(s) of any elevated levels of sediment, silt, or turbidity. Sample results of the run-on discharges may demonstrate elevated levels of TSS, SSC, SS, or turbidity in the run-on. If elevated levels are found, the run-on should be included in the source identification. As a result of this offsite source of pollutants, a corrective action may include the identification of adjacent landowner discharges to the RWQCB in the Notice of Potential Non-Compliance and other BMP measures to remove pollutants from run-on.

Corrective actions may need to be implemented to reduce the loading during future events. These procedures are discussed further in Section 2.4.

2.3 Implementing the Sampling Program

This section covers topics relevant to implementing the sampling program, including: training, preparation and logistics, sample collection, quality assurance/quality control, laboratory sample preparation and analytical methods, QA/QC data evaluation, and data reporting. The information presented in this section is adopted from Sections 8-13 of the *Caltrans Guidance Manual: Stormwater Monitoring Protocols (Second Edition)* for the sediment/silt or turbidity sampling to be performed at the construction sites.

2.3.1 Training

Familiarity with the requirements of the sampling and analysis plan (SAP) and competence in the techniques and protocols specified in the plan are essential for the collection of water samples in a manner that meets the goals of the plan, while protecting the health and safety of the sampling crewmembers. This section briefly describes the training necessary to provide members of the contractor's sampling crew with the knowledge and skills to perform their assigned duties competently and safely.

Field monitoring training should include the following basic elements:

- Review Sampling and Analysis Plan
- Review Health and Safety
- Training/Sampling Simulation (Dry Run)

All the contractor's sampling personnel must receive training prior to conducting any sampling activities. Because storm-related sampling events are difficult to predict and construction projects often run for a year or more, there is a good chance that one or more members of the sampling crew may be unavailable to sample a given event due to sick leave, vacation, etc. Thus, it is necessary to designate alternate sampling crewmembers that can fill in when primary members are unavailable. These alternate sampling crewmembers should receive the same training as the primary members in the event that a primary crewmember is unavailable.

Review SAP and Health & Safety. All the contractor's sampling crewmembers and alternates should read the entire SAP developed for the construction site to obtain the background information required for an overall understanding of the project. Including, project organization (event criteria, sampling frequency, etc.), responsibilities, monitoring sites, analytical constituents, monitoring preparation and logistics, sample collection, laboratory methods, QA/QC, data management, clean sampling techniques, and health and safety.

The contractor's sampling crewmembers should also be made aware of potential hazards associated with sampling. These hazards can include slippery conditions, cold or hot temperatures, open water that may be fast moving and or deep, construction site traffic, and contaminated water. Crewmembers need to become familiar with the methods to be employed to cope with those hazards.

Training/Sampling Simulation (Dry Run). A training session should be held for all of the contractor's sampling crewmembers and alternates to review the sampling techniques and protocols specified in the SAP. Ideally, the training session should occur shortly before the expected onset of the wet season.

The contractor's training session should be organized in a chronological fashion, in order to follow the normal train of events from pre-monitoring preparations through post-monitoring activities. All standard operating procedures should be covered, along with the site-specific responsibilities of individual crewmembers. In addition, any questions arising from the document review should be addressed during this session.

Training personnel should circulate a copy of the SAP, and all other appropriate documentation during the training session. The following is an example of items, which should be on hand during a training session:

- Documentation (SAP, equipment manuals, etc.)
- Storm kit and sampling supplies
- Monitoring equipment (and water for demonstration purposes)
- Sample bottles and example bottle labels
- Chain-of-custody form

Key sections of the SAP should be highlighted during the training session, and use of equipment should be demonstrated. To emphasize the importance of minimizing sample contamination, special attention should be given to proper sample handling techniques. Ample opportunity should be provided to answer questions posed by sampling crewmembers.

The training should include a visit to the construction site where a sampling simulation, or "dry run," can be conducted under the supervision of the project manager or sampling crew leader. During the "dry run" sampling crewmembers travel to their assigned sampling locations and run through the procedures specified in the Sample Collection section of the SAP, including:

- Site access and parking at the site
- Traffic control measures (if any)

- Calibrating field equipment
- Preparing the stations for monitoring
- Taking field measurements
- Collecting water samples
- Completing sample labels and field log forms
- Packing samples
- Delivering or shipping samples to the laboratory

All of the equipment and materials required for a wet weather sampling event should be mobilized and used to simulate, as closely as possible, the conditions of an actual sampling event. All sampling crewmembers (including alternates) should receive hands-on training with all field equipment and sample handling procedures. The project manager or sampling crew leader should re-emphasize health and safety considerations during the field sampling simulation.

2.3.2 Preparation and Logistics

Adequate pre-storm preparations are essential for a successful sampling event. Prior to deployment of sampling crews and the initiation of sampling, it is imperative that weather systems are adequately tracked, sampling personnel are prepared, and all necessary equipment is inventoried. Sampling preparation and logistics should include the following basic elements:

- Weather Tracking
- Communications
- Ordering Sample Bottles
- Sample Bottle Labels
- Field Equipment Preparations
- Mobilization of Sampling Crews

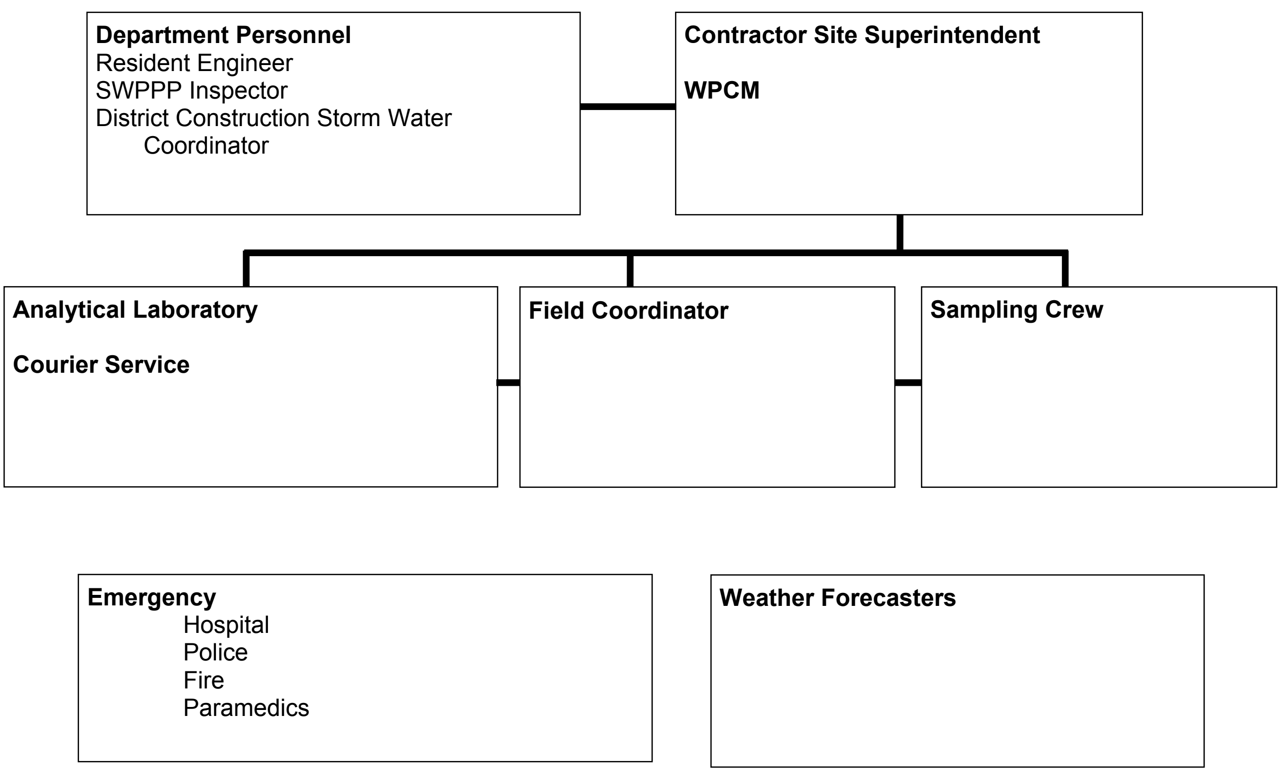
The above listed elements are discussed in this section.

Weather Tracking. Weather tracking is an important element so both the site and sampling crews can prepare prior to the arrival of rain. During the wet season, when the sampling program is active, the resident engineer or Department inspector and the Water Pollution Control Manager (WPCM) or other assigned contractor staff member will need to be assigned to track weather conditions and potential storms.

The frequency of weather tracking increases as incoming storms are identified as candidates for impacting the site and sampling may be required. Weather can be tracked using a number of sources including local newspapers and TV news programs, the Weather Channel, private weather forecasting services for custom site-specific forecasts, the National Weather Service (NWS) at www.nws.noaa.gov, and other Internet sites for radar imagery and hourly weather observations from a network of surface weather monitoring stations throughout California. Appendix C provides information regarding California meteorology and weather tracking.

Communications. A telephone tree should be developed to clearly define lines of communication and notification responsibilities. The telephone tree is used for site and sampling preparation activities, personnel notification of forecasted events, communications during sampling, and coordinating site and BMP evaluations following an event. The telephone tree graphically shows the notification sequence from the resident engineer to WPCM to sampling personnel. The telephone tree should list laboratory personnel numbers for the purpose of sample delivery. Emergency telephone numbers should be listed, including numbers of hospitals nearest the construction site. The telephone tree should include office, pager, cellular, home and any other pertinent telephone numbers for each person involved in the project. It is essential that each person listed on the telephone tree have access to a copy of the telephone tree at all times during the sampling season. An example of a telephone tree is presented as Figure 2-1.

Figure 2-1. Telephone Tree



Ordering Sample Bottles. Prior to the first event of each sampling season, a sample bottle order is placed with the analytical laboratory. The bottle order is based on all planned analyses that will be performed by the laboratory (TSS, SS, SSC, and or turbidity). Enough bottles should be ordered to cover multiple events, and QA/QC samples. Bottles are only used once and cannot be re-used without being cleaned. Therefore, the first order should include two-dozen of each bottle type, more if available storage space is available.

The laboratory provides clean bottles as part of their analytical services. For sediment and turbidity samples, the lab should provide bottles made of polyethylene plastic in a size to collect the required volume, typically 500 or 1000 milliliters. The order should specify wide-mouth bottles; grab sampling is easier to perform with wide-mouth bottles. All bottles must be pre-cleaned according to the procedures specified in Appendix D. Immediately following each monitoring event, the bottle inventory should be checked and additional bottles ordered as needed.

Sample bottles and laboratory-cleaned sampling equipment are handled only while wearing clean, powder-free nitrile gloves. All laboratory-cleaned sampling equipment and bottles are double bagged in plastic bags for storage and stored in a clean area. Sample bottles are stored with lids properly secured.

In addition to bottles, bottle labels need to be ordered. This is another service the laboratory typically provides. Standard labels need to be applied to each sample bottle. Pre-labeling sample bottles simplify field activities. The laboratory should be able to provide pre-labeled bottles with space for writing in site- and event-specific information. A standardized bottle label should include the following information:

- Project name
- Project number
- Unique sample identification number and location.
- Collection date/time (No time applied to QA/QC samples)
- Analysis constituent

Field Equipment Preparations. Prior to the first storm event of each sampling season, and immediately after each monitored event, the sampling crews will inventory, restock, replace, clean, calibrate, maintain, and test field equipment as needed. A standard checklist is used to perform an inventory of field equipment (tools, sample bottles, safety equipment, first-aid kit, cellular telephone, etc.). An example field equipment checklist is provided as Figure 2-2. Field equipment should be kept in one location, which is used as a staging area to simplify sampling crew mobilization.

Mobilization of Sampling Crews. When a storm approaches that may generate a discharge, the WCPM shall alert the sampling crew and analytical laboratory. When first alerted, sampling crewmembers should consult their sampling plan and check field equipment and supplies to ensure they are ready to conduct any sampling. The sampling crew will need to obtain ice (for sample preservation). Ice for grab samples should be kept in ice chests where full grab sample bottles will be placed. Keeping ice in zip-lock bags facilitates clean easy ice handling. Refreezable ice packets are generally not recommended because they are susceptible to leakage. If a discharge is observed, the sampling crewmembers will be ready to perform the required tasks within the first two hours of the discharge.

Figure 2-2. Field Equipment Checklist

- ☐ First aid kit
- ☐ Log books/log sheets
- ☐ "Rite-n-Rain" pens
- ☐ Paper towels
- ☐ Required grab sample bottles
- ☐ Grab pole
- ☐ Weather –resistant camera
- ☐ Rubber bands / Duct tape
- ☐ Cellular phone
- ☐ Personal rain gear
- ☐ Sand bags
- ☐ Sampling and Analysis plan
- ☐ Chain of Custody forms
- ☐ Markers – fine point
- ☐ Coolers and ice
- ☐ Spare bottle labels
- ☐ Intermediate container
- ☐ Powder-free nitrile gloves
- ☐ Zip-lock baggies
- ☐ Hardhat/Orange safety vest
- ☐ Health and Safety Plan

2.3.3 Sample Collection Procedures

A series of five (5) water samples or measurements (turbidity) will be collected at each upstream and downstream station and one (1) sample collected from each run-on location during each event. All the samples will be sent to the laboratory. The laboratory will develop a single composite sample by mixing together equal volumes from each of the five samples collected at a given site. Field measurements will be recorded on the standard field forms.

The following are basic sample collection and handling elements required during sampling:

- Personnel Safety

- Sampling Equipment and Bottles
- Clean Sampling Techniques
- Grab Sample Collection
- Sample Preservation
- Sample Delivery/Chain of Custody

These elements are described below to provide sample collection and handling guidance for sampling personnel.

Personnel Safety. Before samples are collected, personnel must ensure the safety of such activities at each sampling location. Personnel safety should be considered when selecting monitoring sites. Adherence to the following recommendations will minimize risks to sampling personnel:

- At no time during storm conditions or when significant flows are present should sampling personnel enter a river or creek.
- Two-person sampling crews should be available for all fieldwork to be conducted under adverse weather conditions, or whenever there are risks to personal safety.
- Personnel must be trained regarding appropriate on-site construction traffic control measures.

Sampling Equipment and Bottles. It is important to use the appropriate sample bottles and equipment for each parameter to be measured. Improper bottles and equipment can introduce contaminants and cause other errors, which can invalidate the data. Immediately prior to the filling of grab sample bottles, the bottle labels should be checked, and site- and event-specific information added using a waterproof pen. Attempting to label grab sample bottles after sample collection may be difficult because of wet labels.

Clean Sampling Techniques. Storm water quality sampling at Department's construction projects shall employ "clean" sampling techniques to minimize potential sources of sample contamination, particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower. Clean sample collection techniques that should be followed during the collection of water samples are described below. More extensive clean sampling techniques may be required under certain conditions, such as monitoring to assess receiving water impacts. See Appendix D for a detailed description of more extensive clean sampling techniques. Care must be taken during all sampling operations to minimize exposure of the samples to human, atmospheric, and other potential sources of contamination. Care must be taken to avoid contamination whenever handling bottles and lids.

Whenever possible, grab samples should be collected by opening, filling and capping the sample bottle while submerged, to minimize exposure to airborne particulate matter. Additionally, whenever possible, samples should be collected upstream and upwind of sampling personnel to minimize introduction of contaminants. To reduce potential contamination, sample collection personnel must adhere to the following rules while collecting storm water samples:

- No smoking
- Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles).
- Always wear clean, <u>powder-free</u> nitrile gloves when handling bottles, containers and lids.
- Never touch the inside surface of a sample bottle or lid, even with gloved hands.
- Never allow the inner surface of a sample bottle or lid to be contacted by any material other than the sample water.
- Never allow any object or material to fall into or contact the collected sample water.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Do not eat or drink during sample collection.
- Do not breathe, sneeze or cough in the direction of an open sample bottle.

Grab Sample Collection. Manual grab samples are typically collected by direct submersion of each individual sample bottle into the flow stream. It is also acceptable for intermediate containers to be used to collect samples. This intermediate sample is then poured immediately into the appropriate grab sample bottle(s). Intermediate containers are used to collect one large sample to be distributed to several smaller sample bottles to help reduce the sampling time. Intermediate containers are also helpful when a sampling pole is employed because a single container can be attached to the pole and then used to collect multiple samples.

When transferring the sample from the intermediate container to the bottle, it is very important that the sediment be kept in suspension by stirring or swirling the container. Otherwise a portion of the sediment may settle out in the intermediate container and not be included in the sample that will be analyzed.

Samples bottles should be filled to the top. If possible, grab samples should be collected by completely submerging the bottle or container below the surface of the water to avoid collecting any material floating on the surface. When submerging the bottle, avoid hitting the bottom of the water body. Hitting the bottom may disturb the sediment and impact the sample.

For flow depths less than the diameter of the bottle, filling the bottle will not be possible unless an intermediate container is used.

Each bottle should be rinsed out at least once with a small amount of the source water before taking the actual sample. This same procedure should be followed when using an intermediate container to fill a bottle. Both the container and bottle should be rinsed.

The bottle should be opened at the last possible moment and the lid screwed back on immediately after the sample is collected. The lid should be handled carefully during this time to avoid contaminating the inner lining. Hold the lid around the rim and face it down. If possible open and close the bottle under water when collecting a sample.

When collecting samples at the upstream/downstream stations, samples should be collected at the downstream station first. Sampling may disturb the bottom sediment. If the upstream station is sampled first, the disturbed sediment will be carried past the downstream station and possibly impact the downstream sample. At both sites, face upstream to collect a sample.

Wading into a water body to collect a sample should be avoided. Wading will disturb the bottom sediment and increase the suspended sediment levels in the water column where the samples will be collected. Wading into a river or creek is also dangerous during wet-weather events because flow rates are often higher. Wading should only be performed if the flow depth is less than 25 cm or one foot. Approach the sampling point from the downstream.

Standing on the bank and using a sampling pole to collect a sample is a better method. A boat can be used to access sites out in lakes, bays, estuaries, sloughs, and large slow moving rivers.

To collect turbidity measurements using an electronic field meter with a probe, the probe is immersed into the flow stream or a sample contained in the intermediate container. The probe may be attached to the end of the sampling road in order to reach the flow stream. If the meter analyses a small volume of sample, the standard container that comes with the meter can be immersed into the flow stream to collect a sample or immersed in the sample collected by an intermediate container.

As mentioned previously, sampling locations for upstream and downstream sampling stations may vary with each event. Sampling crews should be prepared to modify sampling locations or points in order to maximize the representativeness of the samples. Detailed field notes and or photographs should be used to document the conditions and reasons for selecting a specific location to collect a sample.

Collecting samples of run-on runoff coming on to the construction site from outside sources (run-on) should follow similar procedures. The collection procedures are a little different because run-on will arrive on site as sheet flow or in small drainage channels. To collect samples, the run-on flows will need to be at least 1 centimeter or 0.5 inches. Flows in the drainage channels may reach this depth. If not, several sand bags can be used to constrict the flows. Be careful the flow is not concentrated to the point the channel starts to erode and increases the amount of sediment in the flow.

If the run-on enters the site as sheet flow and does not concentrate in a natural drainage channel, sand bags can be used to concentrate the flow to a depth where samples can be collected.

Filling a sample bottle is difficult when the bottles cannot be completely submerged. An intermediate container should be used. For example, one sample bottle can be designated as the intermediate container and used to collect multiple grab samples to fill the remaining sample bottles. **Keep the sediment in suspension during each transfer.**

Sampling stations should be approached from the downstream with samples collected facing upstream. Hitting the bottom with the bottle probably cannot be avoided, so lower the bottle slowly into the water to minimize the disturbance.

Information regarding the final sampling locations selected for the event and the actual sample collection should all be documented in the Sampling Activity Logs. Photographs are helpful to show the discharge(s), instream conditions, run-on flows, and sample collection methods.

Sample Preservation. All samples are kept on ice or refrigerated to 4 degrees Celsius from the time of sample collection until delivery to the analytical laboratory. The grab samples are placed in an ice chest with ice immediately following collection. In addition to keeping the samples cool it is also important to minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample, resulting in unreliable analytical results. Therefore, all samples are covered or placed in an ice chest with a closed lid immediately following collection. No other preservatives are required.

Sample Delivery/Chain of Custody. All samples must be kept on ice, or refrigerated, from the time of onset of sample collection to the time of receipt by laboratory personnel. If samples are being shipped to the laboratory, place sample bottles inside coolers with ice, ensure that the sample bottles are well packaged, and secure cooler lids with packaging tape. It is imperative that all samples be delivered to the analytical laboratory and analyses begin within the maximum holding times specified by laboratory analytical methods (see Section 2.3.5). The holding times for TSS and SSC are 7 days. The holding times for SS and turbidity are 48 hours. To minimize the risk of exceeding the holding times for SS and turbidity, samples must be transferred to the analytical laboratory as soon as possible after sampling. The sampling crew must in such cases coordinate activities with the analytical laboratory to ensure that holding times can be met.

Chain-of-custody (COC) forms are to be filled out by the sampling crew for all samples submitted to the analytical laboratory. The purpose of COC forms is to keep a record of the transfer of sample custody, and requested analyses. Sample date, sample location, and analysis requested (TSS and SS, SSC, and or turbidity) are noted on each COC.

Any special instructions for the laboratory should also be noted. A note to remind the lab that composite samples need to be developed from the five (5) samples collected at the upstream and downstream stations. The lab should develop the composite by taking equal volumes from each sample. Other instructions can include specifications of lab quality control requirements (e.g., laboratory duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) samples).

Copies of COC forms are kept with field notes in a field logbook. COC forms should be checked to be sure all analyses specified by the sampling plan are included. Review of the COC forms immediately following a storm event gives the data reviewer a chance to review the sampling crews' requests and then to notify the laboratory of additional analyses or necessary clarification. An example of a customized COC form is presented in Section 4.1.

2.3.4 Quality Assurance/Quality Control (QA/QC)

The quality of analytical data is dependent on the ways in which samples are collected, handled and analyzed by the sampling crew and laboratory personnel. Procedures for both field and laboratory measures should be included in the SAP to maximize the data's quality and usefulness. Precision is the major category of QA/QC checks for suspended sediment-related analyses. Comparing the results of duplicate samples that should be the same assesses precision. The following QA/QC elements need to be incorporated into all the sample collection efforts for sedimentation/silt and turbidity:

- Duplicate Samples
- QC Sample Schedule

Duplicate samples, the relevant responsibilities of sampling personnel, and recommended minimum frequencies for creating duplicate samples are discussed below. The results of the field QC samples are then used to evaluate the quality of the reported data (data evaluation is discussed in Section 2.3.6).

Duplicate Samples. Analytical precision is a measure of the reproducibility of data and is assessed by analyzing two samples that are intended to be identical. Any significant differences between the samples indicate an unaccounted-for factor or a source of bias. There are typically two types of duplicate samples that require special sampling considerations: field duplicates and laboratory duplicates.

Field Duplicates. Field duplicates are used to assess variability attributable to collection, handling, shipment, storage and/or laboratory handling and analysis. For grab samples, duplicate samples are collected by the sampling crew simultaneously filling two grab sample bottles at the same location. If intermediate containers are used, first pour an incremental amount into one sample bottle and then pour a similar amount into the second. Continue going back and forth until both bottles are full. Field duplicate samples should be submitted to the laboratory "blind" (i.e. not identified as a QC sample, but labeled with a different site identification than the regular sample). A field duplicate sample should be collected at one station once every 10 samples.

Laboratory Duplicates. Laboratory duplicates (also called laboratory splits) are used to assess the precision of the analytical method and laboratory handling. For the laboratory duplicate analysis the analytical laboratory will split one sample into two portions and analyze each one. When collecting samples to be analyzed for laboratory duplicates, typically double the normal sample volume is required. This requires filling a larger size sample bottle, or filling two normal size sample bottles, labeling one with the site name and the second with the site name plus "laboratory duplicate." Laboratory duplicate samples are collected, handled, and delivered to the analytical laboratory in the same manner as environmental samples. Enough extra sample volume for the laboratory to create a duplicate should be collected at a frequency of one for every 10 samples.

A QC sample schedule should be developed, included in the SAP, and followed closely by sampling personnel. The project QC sample schedule should meet the minimum QC sample frequency criteria over the term of the project.

2.3.5 Laboratory Sample Preparation and Analytical Methods

This section describes the steps to be taken by analytical laboratories to prepare for monitoring events, and the procedures laboratories will use for sample analyses. The following topics are discussed:

- Laboratory Selection and Contracting
- Pre-Sampling Preparations
- Sample Storage and Handling Prior to Analysis
- Reporting Limit Requirements
- Analytical Methods
- Laboratory Data Package Deliverables

Samples will be analyzed for one or more of the constituents presented in Table 2-1. Required analytical method, sample bottle type, target reporting limit, volume required for analysis, sample preservation, and maximum holding time are also presented in Table 2-1. The importance of these elements is incorporated into many of the following discussions.

Table 2-1
Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation and/or Turbidity

Constituent	Analytical Method	Sample Preservation	Minimum Sample Volume	Sample Bottle Type	Maximum Holding Time	Reporting Limit	Estimated Cost
(a) Suspended Sediment Concentration (SSC)	ASTM D3977-97 (A, B, or C)	Store at 4˚ C (39.2˚ F)	500 mL	Polyethylene plastic or glass	7 days	1 mg/L	$15-30
(b) Settleable Solids (SS)	EPA 160.5 Std Method 2540(f)	Store at 4˚ C (39.2˚ F)	1000 mL	Polyethylene plastic or glass	48 hours	0.1 mL/L/hr	$15
(c) Total Suspended Solids (TSS)	EPA 160.2 Std Method 2540(d)	Store at 4˚ C (39.2˚ F)	100 mL	Polyethylene plastic or glass	7 days	1 mg/L	$15
(d) Turbidity	EPA 180.1 Std Method 2130(b)	Store at 4˚ C (39.2˚ F)	50 mL	Polyethylene plastic or glass	48 hours	0.1 NTU	$10

Notes: Adapted from Table 600-1 of the SSWPPP/WPCP Preparation Manual (March 2003)

ASTM – American Society for Testing and Materials
°C – Degrees Celsius
°F – Degrees Fahrenheit
EPA – U.S. Environmental Protection Agency
L – Liter
mL/L/hr – Milliliters per liter per hour
mg/L – Milligrams per liter
mL – Milliliters
NTU – Nephelometric Turbidity Unit
Std Method – Per the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, American Water Works Association

Laboratory Selection and Contracting. Important considerations in selecting an analytical laboratory include location, past performance, ability to meet analytical reporting limits (RLs), and experience with the type of samples that will be generated by the monitoring program. Department of Health Services (DHS) certification is required for Department analytical work. A list of State-certified laboratories that are approved by the Department is available at the following Internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

Pre-Sampling Preparations. The analytical laboratory will be involved in a number of activities prior to the actual analysis of samples, including:

- Determination of key laboratory performance requirements (e.g., maximum reporting limits, turnaround times, report formats) for analytical services contract.
- Develop the procedure for combining the five samples into a single composite sample.
- Review and comment on the data quality evaluation procedures, QC sample schedule, and QC sample volumes.
- Providing sampling crew with clean sample containers and other equipment.
- Coordination with sampling crew prior to each anticipated storm-sampling event including number of samples anticipated, approximate date and time of sampling (if known), and when sample containers will be required

Sample Storage and Handling Prior to Analysis. To minimize the chance of sample contamination and unreliable analytical results, special measures must be taken during the storage and handling of samples prior to analysis. For example, samples must be collected and stored in the appropriate containers and preserved. Samples must be analyzed within established holding times to ensure reliability of the results.

Maximum acceptable holding times are method-specified for various analytical methods. **The holding time starts for each individual grab sample when it is collected and the time is counted until analysis of the sample.** If a sample is not analyzed within the designated holding times, the analytical results may be suspect. Thus, it is important that the laboratories meet all specified holding times and makes every effort to prepare and analyze the samples as soon as possible after they are received. Prompt analysis also allows the laboratory time to review the data and, if analytical problems are found, re-analyze the affected samples.

Reporting Limit Requirements. The reporting limit (RL) is the minimum level at which the analytical laboratory can reliably report detectable values. It is important to ensure that the RLs derived for the project are low enough to provide useful results. The RLs listed in Table 2-1 match the RLs required by the Department in the *Stormwater Monitoring Protocols Guidance Manual*.

Analytical Methods. The recommended analytical methods for measuring TSS, SS, SSC, and turbidity are shown in Table 2-1. All of these methods are described either in "Standard Methods for the Examination of Water and Wastewater or in the listed EPA method.

Laboratory Data Package Deliverables. As a part of the laboratory contract, the data package that will be delivered to contractor and the timing of its delivery (turn around time) should be defined. The data package should be delivered in hard copy and electronic copy (on diskette).

The hard copy data package should include a narrative that outlines any problems, corrections, anomalies, and conclusions, as well as completed chain of custody documentation. A summary of the following QA/QC elements must be in the data package: sample analysis dates, results of method blanks, summary of analytical accuracy (matrix spike compound recoveries, blank spike compound recoveries, surrogate compound recoveries), summary of analytical precision (comparison of laboratory split results and matrix spike duplicate results, expressed as relative percent difference), and reporting limits. Because the laboratory must keep the backup documentation (raw data) for all data packages, raw data (often called Contract Laboratory Program (CLP) data packages) should not be requested.

In addition to the hard copy, an electronic copy of the data can be requested from the laboratory. The electronic copy includes all the information found in the hard copy data package. Data should be reported in a standardized electronic format.

Common turn around times for laboratory data packages are two to three weeks for faxed data and three weeks to thirty days for hard copy and electronic copy. Receiving the faxed data quickly allows an early data review to identify any problems that may be corrected through sample re-analysis.

2.3.6 QA/QC Data Evaluation

Data Screening. When the laboratory reports are received following each sampling event, it is important to check the reported data as soon as possible to identify errors committed in sampling, analysis or reporting. The laboratory must report results in a timely fashion (as defined in the contractor's contract with the laboratory) and the results must then be reviewed immediately upon receipt. This may allow for re-analysis of questionable (out-of-range) results within the prescribed holding time. The initial screening includes the following checks:

- Completeness. The chain of custody forms should be checked to ensure that all laboratory analyses specified in the sampling plan were requested. The laboratory reports should also be checked to ensure that all laboratory analyses are performed as specified on the chain of custody forms, including the requested QA/QC analyses.

- Holding Time. The lab reports need to be checked to verify that all analyses were performed within the prescribed holding times.

- Reporting Limits. The reported analytical limits should meet or be lower than the levels agreed upon prior to laboratory submission.

- Reporting Errors. On occasion laboratories commit typographical errors or send incomplete results. Reported concentrations that appear out of range or inconsistent are indicators of potential laboratory reporting problems, and should be investigated when detected. Examples of this would be a reported value being an order of magnitude different than concentrations reported for the same constituent for other events.

Irregularities found in the initial screening should immediately be reported to the laboratory for clarification or correction. This process can identify and correct errors that would otherwise cause problems further along in the data evaluation process, or in subsequent uses of the data for higher-level analysis. When appropriate, reanalysis of out-of-range values can increase confidence in the integrity of questionable data.

The laboratory data can also be reviewed using the Department Stormwater Management Program Laboratory EDD Error Checker. The laboratory will need to be trained to use the tool and report the data in a standard electronic format.

Data Validation. The data quality evaluation process is structured to provide checks to ensure that the reported data accurately represented the concentrations of constituents actually present in water quality samples. Data evaluation can often identify sources of contamination in the sampling and analytical processes, as well as detect deficiencies in the laboratory analyses or errors in data reporting. Data quality evaluation allows monitoring data to be used in the proper contest with the appropriate level of confidence.

QA/QC parameters that should be reviewed are classified into the following categories:

(1) Contamination check results (method, field, and equipment blanks)

(2) Precision analysis results (laboratory, field, and matrix spike duplicates)

(3) Accuracy analysis results (matrix spikes and laboratory control samples)

Each of these QA/QC parameters should be compared to the data quality objectives listed in Table 2-2. The key steps in the analysis of each of these QA/QC parameters are:

(1) Compile a complete set of the QA/QC results for the parameter being analyzed.

(2) Compare the laboratory QA/QC results to accepted criteria.

(3) Compile any out-of-range values and report them to the laboratory for verification.

(4) Attach appropriate qualifiers to data that do not meet QA/QC acceptance criteria.

(5) Prepare a report that tabulates the success rate for each QA/QC parameter analyzed.

Refer to Section 13 of the Department *Stormwater Monitoring Protocols Guidance Manual* provided in Appendix E for specific direction on evaluating the results of contamination, accuracy, and precision checks, and on qualifying data that do not meet data quality objectives.

Table 2-2
Control Limits for Precision and Accuracy for Water Samples

Constituent	Method	Maximum Allowable RPD	Recovery Lower Limit	Recovery Upper Limit
SSC	ASTM D3977-97 (A, B, or C)	20%	80%	120%
SS	EPA 160.5 Std Method 2540(f)	20%	80%	120%
TSS	EPA 160.2 Std Method 2540(d)	20%	80%	120%
Turbidity	EPA 180.1 Std Method 2130(b)	20%	NA	NA

Notes: RPD = relative percent difference between duplicate analyses.
Recovery, lower and upper limits refer to analysis of spiked samples.

2.3.7 Data Management and Reporting

To facilitate data management, analysis, and the comparison of results, a standard system for data reporting should be developed for the project. Both electronic and hardcopy data must be filed in Category 20 of the project files in an organized and easily accessible fashion.

To keep the data organized, each monitoring site, station, and sampling event should be assigned a unique identification number. All the data should be organized and associated with these numbers.

The SSP requires the results of field analyses (turbidity) must be submitted to the resident engineer within five (5) days of taking the measurement. Results from laboratory analyses (TSS, SS, SSC, or turbidity) must be submitted within 30 days of collecting the samples. QA/QC data must accompany the field and or analytical data.

Attribute date should also be collected to assist with interpreting the data. The attribute data usually describes the sample, event, and site. The sample description may provide information on the sample itself: when and how it was collected, what it was analyzed for, the method and lab used to perform the analysis, and the result of the analysis. This section also can characterize the sample source, as well as the portion of a rain event that is represented by the sample.

The event information describes the discharge event itself. This includes when the rain started and stopped, when runoff started and ended, when the discharge to the receiving stream started and ended, and antecedent dry days. Site description information span a range of categories from geographic information and boundaries, such as coordinates, hydrologic sub-area, land use, and size of the watershed, to political data like county, Department and RWQCB district.

All original data documented on sample bottle identification labels, Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. The project may want to consider reporting the electronic data in a format consistent with Department's *2003-2004 Water Quality Data-Reporting Protocols* (November 2003).

2.4 Data Evaluation

The data will be evaluated to identify impacts on the receiving water quality caused by discharges from the construction site and the conditions or areas on the construction site that may be causing the sediment, silt, and or turbidity in the runoff. The data involved in the evaluation include:

- Information gathered from the required site inspections before, during, and after storm events
- Sampling results from upstream and downstream of discharges from the construction site to the receiving water
- Sampling results of runoff that enters the construction site from areas upstream of the site

The upstream sample, while not representative of pre-construction levels, provides a basis for comparison with the sample collected downstream of the construction site. The downstream water quality sample analytical results will be evaluated to determine if the downstream sample(s) show elevated levels of the tested constituent relative to the levels found in the upstream sample.

The run-on sample analytical results will be used as an aid in evaluating potential offsite influences on water quality results. The result from any run-on samples need to be evaluated to determine if the run-on is contributing to elevated levels of sediment, silt, or turbidity. Sample results of the run-on discharges may demonstrate elevated levels of TSS, SSC, SS, or turbidity in the run-on. If elevated levels are found, the run-on should be included in the source identification process.

This evaluation will be performed for every discharge event that samples are collected. Results of the evaluation, including figures with sample collection locations, will be submitted to the resident engineer along with the water quality analytical results and the QA/QC data. Should the downstream sample concentrations exceed the upstream sample concentrations, site personnel will evaluate the BMPs, site conditions, surrounding influences (including run-on sample analysis), and other site factors to determine the probable cause for the increase. As determined by the data and project evaluation, appropriate BMPs will be repaired or modified to mitigate increases in sediment concentrations in the water body. Any revisions to the BMPs will be recorded as an amendment to the SWPPP.

2.4.1 Identifying Water Quality Impacts

To identify water quality impacts within the 303(d) listed water body, the percent difference between the upstream data and downstream data are calculated for TSS, SS, SSC or turbidity. The percent difference is calculated using the following formula:

$$(\text{Upstream result} - \text{Downstream result}) / \text{Upstream result} * 100$$

If any of the results are reported as non-detects (ND), a value of one-half the reporting limit (RL) should be used.

A percent difference greater than 25 percent indicates a substantial impact. Any negative value indicates the downstream concentration was lower than the upstream concentration, which indicates an improvement in water quality and no impact.

The results of the run-on samples should be compared to the results from both the upstream and down stations. If the levels of TSS, SS, SSC, and or turbidity in the run-on are higher than the upstream levels, this indicates the run-on could impact the instream levels and should be investigated further. If the levels in the run-on are higher than the downstream levels, the potential for instream impact may be even greater.

2.4.2 Assessing the Need for Corrective Measures

If a comparison of the upstream and downstream samples indicates an increase in silt, sediment and/or turbidity has occurred, the source needs to be identified and corrective measures identified.

Information gathered from the required site inspections before, during, and after storm events will be used to identify the source(s). SWQTF (2001) developed the following list of conditions or areas on a construction site that may cause sediment, silt, and/or turbidity in runoff:

- Exposed soil areas with inadequate erosion control measures
- Active grading areas
- Poorly stabilized slopes
- Lack of perimeter sediment controls
- Areas of concentrated flow on unprotected soils
- Poorly maintained erosion and sediment control BMP
- Unprotected soil stockpiles
- Failure of an erosion or sediment control BMP

If any one of these conditions and areas is found during the inspections, their presence should be documented, preferably with GPS coordinates and photographs.

All discharges to the receiving water should be traced back to their sources. Document if any of the routes cross one or more of the conditions or areas listed above. If the source of the discharge is run-on to the construction site, the levels of sediment/silt or turbidity from run-on samples should be evaluated. High levels will indicate that the sources outside of the construction site may be contributing to the sediment load. The identification of adjacent landowner discharges should be included in the Notice of Potential Non-Compliance and other BMP measures as the first step to remove pollutants from run-on.

2.4.3 Implementing Corrective Measures

If the construction site or run-on is found to be contributing sediment and silt to the runoff, the following steps should be taken as soon as possible:

(1) Repair or replace any BMP that has failed, resulting in a discharge and or elevated levels of sediment/silt or turbidity in the runoff

(2) Improve maintenance at all BMPs that did not function as designed, resulting in a discharge and or elevated levels of sediment/silt or turbidity in the runoff

(3) Implement BMPs in areas identified as generating discharges or sources of sediment/silt or turbidity

(4) Implement additional or alternative BMPs to provide an effective combination of erosion and sediment control measures on the site

2.4.4 Reporting Non-Compliance

Reporting requirements are discussed in section C-2, Receiving Water Limitations for Construction Activities, of the General Permit. Should the data and evaluations indicate storm water and/or authorized non-storm water discharges are causing or contributing to an exceedance of an applicable water quality standard of a 303(d)-listed water body, the following shall occur:

(1) The contractor shall notify the resident engineer verbally within 48 hours of the identification that a discharge occurred. The Department shall notify the RWQCB by telephone within 48 hours of a discharge that a discharge occurred.

(2) A Notice of Discharge will follow verbal notification to the RE and a Notice of Potential Non-compliance to the RWQCB. These reports will include:

   a) The nature and case of the water quality standard exceedance

   b) The BMPs currently being implemented

   c) Corrective actions performed or to be performed to reduce the pollutant loads including any maintenance or repair of BMPS

   d) Additional BMPs which will be implemented to prevent or reduce pollutants that are causing or contributing to the exceedance of water quality standards

   e) Implementation schedule for corrective actions

   The contractor shall submit a Notice of Discharge pursuant to section 600. 2 of the SWPPP to the resident engineer within 7 days. The Department shall submit a report of Potential Non-compliance to the RWQCB within thirty days.

(3) Amend the SWPPP and monitoring program for the construction site to reflect any additional BMPs that have been and will be implemented, the implementation schedule, and additional monitoring requirements.

Section 3
Monitoring Program for Pollutants Not Visually Detectable in Storm Water

3.1 Permit Requirements/ Special Provisions

The standard requirements for monitoring non-visible pollutants at Department construction sites are presented in Special Provisions (SPs) Section 10.1, Sampling and Analytical Requirements. These requirements are based on the requirements listed in both the Department's NPDES Storm Water Permit, and the Statewide General Permit for Construction Sites. According to Section 10.1:

> "The contractor is required to implement specific sampling and analytical procedures to determine whether BMPs implemented on the construction site are preventing pollutants that are known or should be known by Permittees to occur on construction sites that are not visually detectable in storm water discharges, to cause or contribute to exceedances of water quality objectives."

Potential non-visible pollutants at the construction site are identified in the project SWPPP and construction material inventories. Sampling for non-visibly detectable pollutants is required under the following two conditions:

- Visual inspections performed before, during and after storm events, indicate that there has been a breach, malfunction, leakage or spill of a BMP that is designed to contain the pollutants and the pollutants may or have come in contact with runoff

- Storm water runoff comes into contact with soil amendments, other exposed materials, or site contamination

However, sampling and analysis are only required if the suspected contaminated runoff is discharged from the construction site and enters a storm drain system or water body. Sampling is not required if all runoff is contained on-site and allowed to infiltrate or evaporate. Prior to conducting sampling and analysis at a construction site for non-visible pollutants, a sampling strategy needs to be formulated. The basis of the strategy will involve:

- Where construction materials and potential sources of pollutants are located on the construction site.

- The sampling locations for collecting water quality samples and the rationale for their selection.

- A list of analytical parameters or indicators associated with non-visible pollutants located on the site.

- The sampling schedule that specifies water quality samples will be collected during the first two hours of discharge from rain events during daylight hours (sunrise to sunset), and shall be collected regardless of the time of year, status of the construction site, or day of the week.

3.2 Designing a Sampling Strategy

The SPs, along with the General Permits, identify specific requirements that must be included in any sampling and analysis program for non-visible pollutants. The incorporation of these requirements into an overall sampling strategy will be discussed in this section. The contractor must include in the SWPPP a sampling and analysis plan (SAP) for non-visible pollutant monitoring if required by the project SPs.

3.2.1 Sampling and Analysis Plan (SAP)

A sampling and analysis plan (SAP) for non-visible pollutant monitoring must be included in the SWPPP. The purpose of the SAP is to provide standard procedures to be followed every time a sample is collected and analyzed, and the results evaluated. Following the plan maximizes the quality and usefulness of the data.

The SAP shall be prepared in conformance with protocols and guidelines discussed in this document and the Department's Guidance Manual: Stormwater Monitoring Protocols (Caltrans July 2000). The Guidance Manual is available on the Department's Internet site http://www.dot.ca.gov/hq/env/stormwater/special/index.htm. Properly trained staff in field water quality sampling procedures, laboratory analytical methods, and data validation procedures should prepare the SAP. The analytical laboratory should provide input to ensure that the SAP (especially the QA/QC portion) is realistic, and consistent with the laboratory's operating procedures. Sampling personnel should also provide input regarding logistical details to maximize the practicality and usefulness of a SAP.

The SAP should include a thorough description of all activities required to implement the monitoring program. The plan should be organized to provide an overview of the project goals and organization, followed by a description of all monitoring activities in the chronological sequence in which they will typically occur. That is, pre-monitoring preparations should be described, followed by activities to be undertaken during storm events, followed by post-storm activities. The plan should specify the quality assurance/quality control protocols that will be followed by field and laboratory personnel, and how the field and laboratory results will be managed and reported.

A standard template to be used when preparing a SAP for monitoring non-visible pollutants at all The Department’s construction sites is presented in Section 600.5, Sampling and Analysis Plan for Non-Visible Pollutants, in the SWPPP/WPCP Preparation Manual (Caltrans March 2003). Section 600.5 can be found in Appendix B.

The required SAP for Non-Visible Pollutants, as it is referred to in Section 600.5, will contain the following sections:

- Scope of Monitoring Activities
- Monitoring Strategy (including sampling schedule and locations)
- Monitoring Preparation
- Analytical Constituents
- Sample Collection and Handling (including collection procedures, handling procedures, documentation procedures)
- Sample Analysis
- Quality Assurance / Quality Control
- Data Management and Reporting
- Data Evaluation
- Change of Conditions

Standard language, required site-specific information, and instructions for completing this SAP are provided in Section 600.5.

3.2.2 Is Sampling Required?

Sampling is required if the following three criteria are satisfied:

(1) Materials are known to be on-site that:

  a) Are a source of non-visually detectable pollutants in storm water runoff; and

  b) Cause or contribute to changes in the quality of receiving waters

(2) The materials come in contact with storm water

(3) The contaminated storm water is discharged from the site

Potential non-visible pollutants at the construction site are identified in the project SWPPP construction material inventory section. This includes the following materials (SWQTF 2001):

- Those being used in the construction activities
- Those stored on the construction site

- Those spilled during construction operations and not cleaned up
- Those stored (or used) in a manner that presented the potential for a release of the materials during past land use activities
- Those spilled during previous land use activities and not cleaned up
- Those applied to the soil as part of past land use activities

Construction material inventories and the project SWPPP shall provide information on materials currently in use or proposed for use on the construction site. Common materials used at construction sites that can contaminate runoff with non-visible pollutants are listed in Table 3-1, adapted from Attachment S of the Model SWPPPs. This list is not meant to be inclusive but to provide direction to construction site operators. The State Water Resources Control Board plans to conduct research into non-visible pollutants to provide further guidance and information on appropriate analytical and field tests for common construction pollutants (SWQTF 2001).

Table 3-1
List of Common Potential Non-Visible Pollutants at Construction Projects

Category	Potential Pollutant Source	Category	Potential Pollutant Source
Portland Concrete Cement & Masonry Products	Masonry products	Landscaping	Pesticides/Herbicides
	Sealant (MMA)		Fertilizers
	Ash, slag, sand, waste		Lime and gypsum
	Curing compounds		Aluminum sulfate, sulfur
Painting	Resins	Treated wood	ACZA, CCA, ACA
	Thinners		Cu Naphthenate
	Paint Strippers	Soil amendments & Stabilization Products	Gypsum
	Solvents		Polymer/Copolymer
	Lacquers, varnish, enamels, turpentine		Lignin Sulfonate
	Sealants		Psyllium
Cleaning	Acids		Guar/Plant Gums
	Bleaches	Line flushing	Chlorinated water
	TSP	Portable toilets	Bacteria, disinfectants
	Solvents	Adhesives	Adhesives
Contaminated Soil	Lead	Dust Palliative Prod.	Salts
	Mining & Ind. waste	Vehicle	Batteries

Source: Attachment S (SWPPP/WPCP Preparation Manual 2003)

To determine if potential pollutants exist on the construction site as a result of past land use activities, existing environmental and real estate documentation maybe included in the resident engineer pending files should be reviewed (SWQTF 2001). Good sources of information on previously existing contamination and past land uses recommended by the SWQTF include environmental assessments, initial studies, environmental impact reports or environmental impact statements prepared under the requirements of the National Environmental Policy Act or the California Environmental Quality Act, and Environmental Assessments prepared for property transfers. In some instances, the results of soil chemical analyses may also be available in the resident engineer pending file and can provide additional information on potential contamination.

If a material is identified to be on a site, than a sampling and analysis plan needs to be developed because the potential exists for the material to come in contact with storm water and the contaminated storm water exit the site.

The SPs require that water quality sampling will be triggered when any of the following conditions are observed during the required storm water inspections conducted before or during a rain event:

(1) Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions.

(2) Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (a) a breach, leakage, malfunction, or spill is observed; and (b) the leak or spill has not been cleaned up prior to the rain event; and (c) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

(3) Construction activities, such as application of fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound have occurred during a rain event or within 24 hours preceding a rain event, and there is the potential for discharge of pollutants to surface waters or drainage system.

(4) Soil amendments, including soil stabilization products, with the potential to alter pH levels or contribute toxic pollutants to storm water runoff have been applied, and there is the potential for discharge of pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentration levels of non-visible pollutants in the soil amendment).

(5) Storm water runoff from an area contaminated by historical usage of the site is observed to combine with storm water, and there is the potential for discharge of pollutants to surface waters or drainage system.

Sampling and analysis is not required under the following conditions (SWQTF 2001):

- Where a construction project is self-contained and does not allow any contaminated runoff to exit the site.

- Where construction materials and compounds are kept or used so that they never come in contact with storm water (e.g., in water-tight containers, under a water-tight roof, inside a building, etc.).
- Where for specific materials, the BMPs implemented at the construction site fully contain the exposed pollutants (e.g., bermed concrete washout area).
- For building or landscape materials that are in their final constructed form or are designed for exposure (e.g., fence materials, guardrails, painted structures, support structures and equipment that will remain exposed at the completion of the project, etc.).
- Where pollutants may have been spilled or released on-site, but have been properly cleaned-up and storm water exposure has been eliminated prior to a storm event.

3.2.3 Data Requirements

Samples of runoff will be analyzed for water quality indicators that are associated with each exposed construction material. The results will identify the level of contamination, and the potential impacts to receiving waters and their water quality objectives.

For some materials, the water quality indicator will be the compound itself. For example, if the pesticide, Diazinon, is used on the site, samples of runoff will be analyzed specifically for the Diazinon concentration. For sites contaminated by historic practices, the runoff samples are typically analyzed for specific compounds.

For other materials, an associated indicator will be measured. In the case of general masonry products, their potential impact on water quality involves alteration of the pH level. Therefore, the pH levels will define the impacts curing compounds have on water quality.

Table 3-2 lists the water quality indicators to be used for each of the materials commonly found at construction sites. Some of the indicators can be analyzed in the field and others required analysis in laboratories. Table 3-2 identifies which indicator can be measured in the field and or laboratory.

It is important that the method of measurement be consistent during each sampling event and throughout the program to maximize the comparability of the various samples. Samples analyzed by different methods cannot be easily compared.

A State-certified laboratory is required to perform the analyses in conformance with the EPA requirements listed in 40 CFR 136. A list of State-certified laboratories that are approved by the Department is available at the following Internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

Table 3-2
List of Water Quality Indicators Associated with the Common Potential Non-Visible Pollutants at Construction Projects

Category	Potential Pollutant Source	Water Quality Indicator	Field Analysis	Laboratory Analysis
Portland Concrete Cement & Masonry Products	Masonry products	**pH**, alkalinity	X	X
	Sealant (MMA)	**Methyl methacrylate**		X
	Ash, slag, sand, waste	**Al, Ca, Vanadium, Zn**		X
	Curing compounds	**pH**, VOC, SVOC	X - pH	X
Painting	Resins	**COD**, SVOC		X
	Thinners	VOC, **COD**		X
	Paint Strippers	**VOC**, SVOC		X
	Solvents	**COD**, VOC, SVOC		X
	Lacquers, varnish, enamels, turpentine	**COD**, VOC, SVOC		X
	Sealants	**COD**		X
Cleaning	Acids	**pH**	X	X
	Bleaches	**Residual chlorine**	X	X
	TSP	**Phosphate**	X	X
	Solvents	**VOC**, SVOC		X
Contaminated Soil	Lead	**Lead**		X
	Mining & Ind. Waste	Contaminate specific		
Landscaping	Pesticides/Herbicides	Contaminate specific		X
	Fertilizers	Phosphate, TKN, **NO_3**, TOC, COD	X - NO_3	X
	Lime	**pH**, alkalinity	X	X
	Aluminum sulfate, sulfur	Al, **TDS**, sulfate	X - sulfate	X
Treated wood	ACZA, CCA, ACA	As, Cr, **Cu**, Zn		X
	Cu Naphthenate	**Cu**		X
Soil amendments & Stabilization Products	Gypsum	pH, Ca, **sulfate**, Al, Br, Mn, Va	X – pH, sulfate	X
	Polymer/Copolymer	**TKN**, NO_3, BOD, COD, DOC, sulfate, Ni	X - sulfate	X
	Lignin Sulfonate	Alkalinity, **TDS**	X – alka.	X
	Psyllium	COD, **TOC**		X
	Guar/Plant Gums	COD, **TOC**, Ni		X
Line flushing	Chlorinated water	**Residual chlorine**	X	X
Portable toilets	Bacteria, disinfectants	**Total/fecal coliform**		X
Adhesives	Adhesives	COD, **Phenols**, SVOC		X
Dust Palliative Prod.	Salts	Chloride, **TDS**, cations	X - chloride	X
Vehicle	Batteries	**pH**, lead	X - pH	X

Note: **Bolded** water quality indicator indicates lowest analysis cost or best indicator. However, the composition of the specific construction material, if known, is the first criterion for selecting which analysis to use.

Source: Attachment S (SWPPP/WPCP Preparation Manual 2003)

3.2.4 Where to Sample

The SPs require that the sampling for non-visible pollutants be performed at the following locations:

(1) Down gradient of areas identified by visual observations/inspections where known sources of non-visible pollutants have come in contact with storm water.

Material storage may be confined to small areas of the construction site. Sampling locations from this type of site will be limited to the area immediately down gradient of the sites or their BMPs.

(2) Control area within the construction site where the runoff does not come into contact with materials, wastes or areas associated with potential non-visible pollutants or disturbed soil areas.

The control site for collecting the uncontaminated runoff sample will be a location that is not affected by material storage activities or by runoff from material storage areas.

(3) Immediately down gradient of the run-on to the Department's right of way if the run-on comes in contact with the non-visible pollutant source.

Historic contamination or exposed materials, such as soil amendments, may be widely spread throughout the construction site. There will probably be a number of potential sampling locations. Points where the runoff leaves the site would be the most suitable. Locating a control site or runoff stream may be more difficult. A sampling location may not exist on the site itself and may have to be located at the perimeter of the construction site. Areas with historic contamination or where soil amendments have been applied need to carefully mapped so the control site can avoid these areas.

The use and application of products throughout the construction site will require sampling be performed down gradient of where these product were applied. For example, the application of fertilizer, herbicides, or pesticides during landscaping will require sampling down gradient if storm event occurs during or soon after application. Other sampling points for product applications include bridge drains in order to monitor concrete sealant applied to bridge decks or down gradient of where paint has been applied or solvents have been used to clean equipment.

Uncovered stockpiles of material containing non-visible pollutants will require sampling down gradient of where these products were stored. For example, the storage of aerially deposited lead contaminated soils, pressure treated wood in stockpiles without plastic covers, or applied soil stabilization materials will require sampling down gradient.

The boundary of the construction site should be inspected for evidence of runoff coming on to the site from outside areas. Existing drainage channels (large and small) should be noted and their paths followed through the construction site. If any of the paths flow through a material storage or contaminated area, the sampling station should be established at the upstream boundary of the construction site. These potential sampling stations should be marked in the field and on site maps. Only runoff that is concentrated can be sampled. Run-on that enters as overland sheet flow will require the use of sand bags to either concentrate the flow or create a pond from which to draw a sample.

In general, each potential sampling station should be visited to confirm the expected site characteristics and verify whether the site is suitable for the needs of the program. When possible, a visit should be conducted during a storm, so the runoff path can be observed. A wet-weather visit can provide valuable information regarding logistical constraints that may not be readily apparent during dry weather. However, a dry weather visit should also be conducted to observe any non-storm water flows. Information to gather during a site visit may include whether an appropriate sampling location exists, potential safety issues, and site access.

Sampling locations shall be shown on the SWPPP Water Pollution Control Drawings (WPCDs). GPS coordinates or post miles can be used to define locations. A unique number should be selected for each construction site by which samples can be identified.

3.2.5 When to Sample

The SPs require that:

- Water quality samples shall be collected at each sampling locations during the first two hours of a discharge
- Sampling will only be performed during daylight hours (sunrise to sunset)
- Samples shall be collected regardless of the time of year, status of the construction site, or day of the week
- A minimum of 72 hours of dry weather shall occur between rain events to distinguish separate rain events

Discharges from a construction site can occur anytime during a rain event. Runoff may not occur for some time after the start of the rain. Therefore, the site will need to be monitored throughout each day when rain is falling.

An attempt shall be made to collect samples that are representative of upstream and downstream water quality by considering the following considerations:

An attempt should be made to collect samples that are representative of the runoff from the test and the control stations as defined by the following considerations:

- Collecting a single sample at each station during the first two hours of a discharge event
- All samples are sent to the laboratory for analysis

3.2.6 Sampling Methods and Equipment

Manual grab sampling techniques will be used to collect samples for all the potential non-visible pollutant analyses. A grab sample is an individual sample collected at one specific location at one point in time. Analysis of a grab sample provides a "snapshot" of the quality.

Grab samples are most often collected using manual methods as opposed to using automatic sampling equipment. Water samples for the non-visible pollutant monitoring will be collected manually into sample bottles or, in other cases, possibly measured on-site with an electronic meter or a field kit. Manual sampling entails a person reaching into the flow stream and either collecting a sample of the flow into a container or taking a measurement with an electronic device.

Manual sampling equipment is designed to collect the required sample volume from the either overland sheet or stream flow. The equipment includes bottles or intermediate containers to collect the sample. Intermediate containers are used to collect a larger sample volume and then immediately distribute this sample to individual bottles.

On construction sites, the runoff is in the form of overland sheet flow. It does not follow a define channel. The depth of sheet flow is very shallow; often too shallow to completely submerge a sampling bottle. Under these circumstances, an intermediate container can also be used to collect multiple samples to fill a single sample bottle.

A grab pole can be employed as a means to extend the sample bottle or container out or down into the flow. The pole is designed so the sample bottle or container can be attached to the end.

For all collection efforts, water-sampling devices must be made of chemical resistant materials that will not affect the quality of the sample. For non-visible pollutants, the possible materials include high-density polyethylene plastic, glass, and stainless steel. Polyethylene is preferred over glass and stainless steel because of its durability, resistance to breakage, and lightweight. However, glass is required for the collection of most organic compounds such as PAHs and pesticides. It is important to evaluate each component used to collect a sample for possible sources of sample contamination including bottle lids and protective gloves.

Field kits and electronic equipment is available for certain field-measured analytical parameters as listed in Table 3-2. These kits and meters provide instantaneous results, which reduce the time between sampling and analysis. Field kits range in price from $20 to $1000. Electronic meters range in price from $100 to over a $1000. It is also important to realize the limitations associated with the use of field kits and electronic meters:

- The equipment may not provide low enough detection limits to meet the specific reporting limits
- The meter needs to be calibrated prior to each event to maximize its accuracy
- Assuring the quality and reliability of the results may be difficult
- This equipment is sometime susceptible to fouling and clogging

The cost to have the samples analyzed by a laboratory typically ranges from $10 to $30 per sample, but can be over $100 for some organic compounds.

3.2.7 Data Analysis and Interpretation Methodology

Results from the test and control sites need to be compared to one another for each event. This comparison will indicate that the construction site's storm water discharges may cause or contribute to a water quality exceedance in the receiving water. When the water quality results from the test site are considerably above (or below) the control or background concentrations, the BMPs need to be evaluated to determine what is causing the difference. The comparison will look at the percent difference for all tested parameters.

The result from any run-on samples and the required visual inspections performed before, during and after events, should provide the information needed to identify the cause(s) and or source(s). Corrective actions may need to be implemented to reduce the loading during future events. These procedures are discussed further in Section 3.4.

3.3 Implementing the Sampling Program

This section covers topics relevant to implementing the non-visible pollutant monitoring program, including: training, preparation and logistics, sample collection, quality assurance/quality control, laboratory sample preparation and analytical methods, QA/QC data evaluation, and data reporting. The information presented in this section was adapted from Sections 8-13 of the *Department's Guidance Manual: Stormwater Monitoring Protocols (Second Edition)*.

3.3.1 Training

Familiarity with the requirements of the sampling and analysis plan (SAP) and competence in the techniques and protocols specified in the plan are essential for the collection of water samples in a manner that meets the goals of the plan, while protecting the health and safety of the sampling crewmembers, while protecting the health and safety of the sampling crewmembers. This section briefly describes the training necessary to provide members of the sampling crew with the knowledge and skills to perform their assigned duties competently and safely.

Field monitoring training should include the following basic elements:

- Review Sampling and Analysis Plan
- Review Health and Safety
- Training/Sampling Simulation (Dry Run)

All contractor's field personnel must receive training prior to conducting any sampling activities. Because storm-related sampling events are difficult to predict and construction projects often run for a year or more, there is a good chance that one or more members of the sampling crew may be unavailable to sample a given event due to sick leave, vacation, etc. Thus, it is necessary to designate alternate sampling crewmembers that can fill in when primary members are unavailable. These alternate sampling crewmembers should receive the same training as the primary members in the event that a primary crewmember is unavailable.

Review SAP and Health & Safety. All the contractor's sampling crewmembers and alternates should read the entire SAP developed for the construction site to obtain the background information required for an overall understanding of the project. Including, project organization (event criteria, sampling frequency, etc.), responsibilities, monitoring sites, analytical constituents, monitoring preparation and logistics, sample collection or field measurement, laboratory methods, QA/QC, data management, clean sampling techniques, and health and safety.

The contractor's crewmembers should also be made aware of potential hazards associated with sampling. These hazards can include slippery conditions, cold or hot temperatures, construction site traffic, and contaminated water. Crewmembers need to become familiar with the methods to be employed to cope with those hazards.

Training/Sampling Simulation (Dry Run). A training session should be held for all of the contractor's sampling crewmembers and alternates to review the sampling techniques and protocols specified in the SAP. Ideally, the training session should occur shortly before the expected onset of the wet season.

The contractor's training session should be organized in a chronological fashion, in order to follow the normal train of events from pre-monitoring preparations through post-monitoring activities. All standard operating procedures should be covered, along with the site-specific responsibilities of individual crewmembers. In addition, any questions arising from the document review should be addressed during this session.

Training personnel should circulate a copy of the SAP, and all other appropriate documentation during the training session. The following is an example of items, which should be on hand during a training session:

- Documentation (SAP, equipment manuals, etc.)
- Storm kit and sampling supplies
- Monitoring equipment (and water for demonstration purposes)
- Sample bottles and example bottle labels
- Chain-of-custody form

Key sections of the SAP should be highlighted during the training session, and use of equipment should be demonstrated. To emphasize the importance of minimizing sample contamination, special attention should be given to proper sample handling techniques. Ample opportunity should be provided to answer questions posed by sampling crewmembers.

The training should include a visit to the construction site where a sampling simulation, or "dry run," can be conducted under the supervision of the project manager or sampling crew leader. During the "dry run" sampling crewmembers travel to their assigned sampling locations and run through the procedures specified in the Sample Collection section of the SAP, including:

- Site access and parking at the site
- Traffic control measures (if any)
- Calibrating field equipment
- Preparing the stations for monitoring
- Taking field measurements
- Collecting water samples
- Completing sample labels and field log forms
- Filling out COCs for each laboratory
- Packing samples
- Delivering or shipping samples to the laboratory

All of the equipment and materials required for a wet weather sampling event should be mobilized and used to simulate, as closely as possible, the conditions of an actual sampling event. All sampling crewmembers (including alternates) should receive hands-on training with all field equipment and sample handling procedures. The project manager or sampling crew leader should re-emphasize health and safety considerations during the field sampling simulation.

3.3.2 Preparation and Logistics

Adequate pre-storm preparations are essential for a successful sampling event. Prior to deployment of sampling crews and the initiation of sampling, it is imperative that weather systems are adequately tracked, field personnel are prepared, and all necessary equipment is inventoried. Sampling preparation and logistics should include the following basic elements:

- Weather Tracking
- Communications
- Ordering Sample Bottles
- Sample Bottle Labels
- Field Equipment Preparations
- Mobilization of Sampling Crews

The above listed elements are discussed in this section.

Weather Tracking. Weather tracking is an important element so both the site and sampling crews can prepare prior to the arrival of rain. During the wet season, when the sampling program is active, the resident engineer or Department inspector and the Water Pollution Control Manager (WPCM) or other assigned contractor staff will need to be assigned to track weather conditions and potential storms. The frequency of weather tracking increases as incoming storms are identified as candidates for impacting the site and sampling may be required. Weather can be tracked using a number of sources including local newspapers and TV news programs, the Weather Channel, private weather forecasting services for custom site-specific forecasts, the National Weather Service (NWS) at www.nws.noaa.gov, and other Internet sites for radar imagery and hourly weather observations from a network of surface weather monitoring stations throughout California. Appendix C provides information regarding California meteorology and weather tracking.

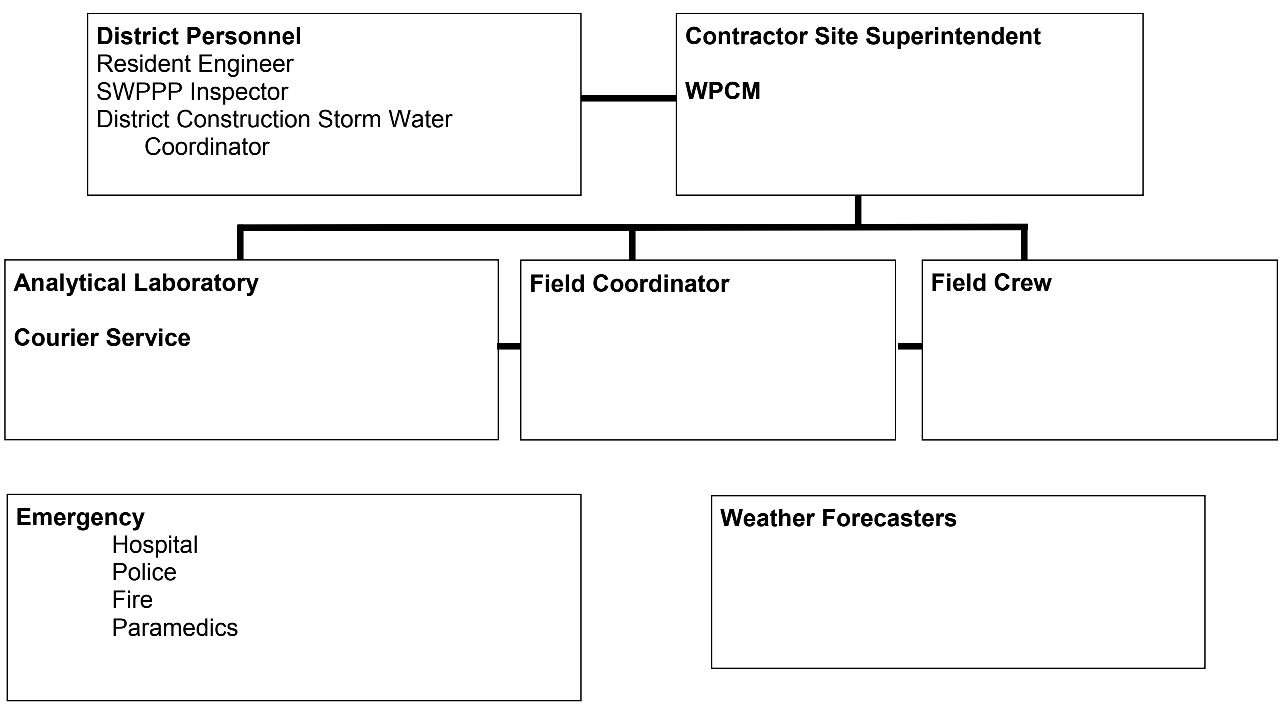
Communications. A telephone tree should be developed to clearly define lines of communication and notification responsibilities. The telephone tree is used for site and sampling preparation activities, personnel notification of forecasted events, communications during sampling, and coordinating site and BMP evaluations following an event. The telephone tree graphically shows the notification sequence from the resident engineer to the WPCM to field water quality sampling personnel. The telephone tree should list laboratory personnel numbers for the purpose of sample delivery. Emergency telephone numbers should be listed, including numbers of hospitals nearest the construction site. The telephone tree should include office, pager, cellular, home and any other pertinent telephone numbers for each person involved in the project. It is essential that each person listed on the telephone tree have access to a copy of the telephone tree at all times during the sampling season. An example of a telephone tree is presented as Figure 3-1.

Ordering Sample Bottles. Prior to the first event of each sampling season, a sample bottle order is placed with the analytical laboratory. The bottle order is based on all planned analyses that will be performed by the laboratory. Enough bottles should be ordered to cover multiple events, and QA/QC samples. Bottles are only used once and cannot be re-used without being cleaned. Therefore, the first order should include two-dozen of each bottle type, more if available storage space is available.

The laboratory provides clean bottles as part of their analytical services. For most samples, the lab should provide bottles made of either polyethylene plastic or glass in a size to collect the required volume, typically 250, 500, or 1000 milliliters. The order should specify wide-mouth bottles; grab sampling is easier to perform with wide-mouth bottles. All bottles must be pre-cleaned according to the procedures specified in Appendix D. Immediately following each monitoring event, the bottle inventory should be checked and additional bottles ordered as needed.

Sample bottles and laboratory-cleaned sampling equipment are handled only while wearing clean, powder-free nitrile gloves. All laboratory-cleaned sampling equipment and bottles are double bagged in plastic bags for storage and stored in a clean area. Sample bottles are stored with lids properly secured.

Figure 3-1. Telephone Tree



In addition to bottles, bottle labels need to be ordered. This is another service the laboratory typically provides. Standard labels need to be applied to each sample bottle. Pre-labeling sample bottles simplify field activities. The laboratory should be able to provide pre-labeled bottles with space for writing in site- and event-specific information. A standardized bottle label should include the following information:

- Project name
- Project number
- Unique sample identification number and location.
- Collection date/time (No time applied to QA/QC samples)
- Analysis constituent

Field Equipment Preparations. Prior to the first storm event of each sampling season, and immediately after each monitored event, the sampling crews will inventory, restock, replace, clean, calibrate, maintain, and test field equipment as needed. A standard checklist is used to perform an inventory of field equipment (tools, sample bottles, safety equipment, first-aid kit, cellular telephone, etc.). An example field equipment checklist is provided as Figure 3-2. Field equipment should be kept in one location, which is used as a staging area to simplify sampling crew mobilization.

Figure 3-2. Field Equipment Checklist

☐	First aid kit	☐	Sampling and Analysis plan
☐	Log books/log sheets	☐	Chain of Custody forms
☐	"Rite-n-Rain" pens	☐	Markers – fine point
☐	Paper towels	☐	Coolers and ice
☐	Required grab sample bottles	☐	Spare bottle labels
☐	Parameter-specific field kits or electronic meters	☐	Sand Bags
☐	Weather –resistant camera	☐	Powder-free nitrile gloves
☐	Rubber bands / Duct tape	☐	Zip-lock baggies
☐	Cellular phone	☐	Hardhats /orange safety vests
☐	Personal rain gear	☐	Health and Safety Plan

Mobilization of Sampling Crews. When a storm approaches that may generate a discharge, the WCPM shall alert the sampling crew and analytical laboratory. When first alerted, sampling crewmembers should consult their sampling plan and check field equipment and supplies to ensure they are ready to conduct any sampling. The sampling crew will need to obtain ice (for sample preservation). Ice for grab samples should be kept in ice chests where full grab sample bottles will be placed. Keeping ice in zip-lock bags facilitates clean easy ice handling. Refreezable ice packets are generally not recommended because they are susceptible to leakage. If a discharge is observed, the sampling crewmembers will be ready to perform the required tasks within the first two hours of the discharge.

3.3.3 Sample Collection Procedures

A single water sample or measurement will be collected at each station during each event. Samples will be then be sent to the laboratory. Field measurements will be recorded on the standard field forms.

The following are basic sample collection and handling elements required during sampling:

- Personnel Safety
- Sampling Equipment and Bottles
- Clean Sampling Techniques
- Grab Sample Collection
- Sample Preservation
- Sample Delivery/Chain of Custody

These elements are described below to provide sample collection and handling guidance for field personnel.

Personnel Safety. Before samples are collected, personnel must ensure the safety of such activities at each sampling location. Personnel safety should be considered when selecting monitoring sites. Adherence to the following recommendations will minimize risks to sampling personnel:

- Two-person sampling crews should be available for all fieldwork to be conducted under adverse weather conditions, or whenever there are risks to personal safety.
- Personnel must be trained regarding appropriate on-site construction traffic control measures.

Sampling Equipment and Bottles. It is important to use the appropriate sample bottles and equipment for each parameter to be measured. Improper bottles and equipment can introduce contaminants and cause other errors, which can invalidate the data. All field kits or electronic meters should be used in accordance to manufacturer's instructions. The meter's calibration is typically checked prior to each event.

Immediately prior to the filling of grab sample bottles, the bottle labels should be checked, and site- and event-specific information added using a waterproof pen. Attempting to label grab sample bottles after sample collection may be difficult because of wet labels.

Clean Sampling Techniques. Storm water quality sampling at Department's construction projects shall employ "clean" sampling techniques to minimize potential sources of sample contamination, particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower. Clean sample collection techniques that should be followed during the collection of water samples are described below. More extensive clean sampling techniques may be required under certain conditions, such as monitoring to assess receiving water impacts. See Appendix D for a detailed description of more extensive clean sampling techniques. Care must be taken during all sampling operations to minimize exposure of the samples to human, atmospheric, and other potential sources of contamination. Care must be taken to avoid contamination whenever handling bottles and lids.

Whenever possible, grab samples should be collected by opening, filling and capping the sample bottle while submerged, to minimize exposure to airborne particulate matter. Additionally, whenever possible, samples should be collected upstream and upwind of sampling personnel to minimize introduction of contaminants. To reduce potential contamination, sample collection personnel must adhere to the following rules while collecting storm water samples:

- No smoking
- Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
- Always wear clean, powder-free nitrile gloves when handling bottles, containers and lids.
- Never touch the inside surface of a sample bottle or lid, even with gloved hands.
- Never allow the inner surface of a sample bottle or lid to be contacted by any material other than the sample water.

- Never allow any object or material to fall into or contact the collected sample water.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Do not eat or drink during sample collection.
- Do not breathe, sneeze or cough in the direction of an open sample bottle.

Grab Sample Collection. Manual grab samples are typically collected by direct submersion of each individual sample bottle into the flow. To collect samples, the flows will need to be at least 1 centimeter or 0.5 inches. Overland sheet flows may not reach this depth. If not, several sand bags can be used to either constrict the flows or create a temporary pond. Be careful the flow is not concentrated to the point the channel starts to erode and increases the amount of sediment in the flow.

Filling a sample bottle is difficult when the bottles cannot be completely submerged. An intermediate container should be used. For example, one sample bottle can be designated as the intermediate container and used to collect multiple grab samples to fill the remaining sample bottles. **Keep the sediment in suspension during each transfer.**

Collecting grab measurements with either electronic meters or field tests kits will most likely require a sample of the water to be collected. Flows may not be sufficiently deep enough to completely submerge the meter’s probe. Therefore, a sample will need to be collected in a container of sufficient volume to submerge the probe. This container should be clean and rinsed once with a sample of the source water.

Most field kits will have a container to collect the required sample volume. This container should be rinsed prior to collecting the sample. Since each kit will probably have only one container, a clean laboratory sample bottle may be used at each site to avoid cross contamination. However, if a specific sample volume is required, the test kit container may have to be rinsed with both distilled water and source water in between each sample.

Sampling stations should be approached from downstream of the suspected sampling site. Samples or field measurements shall be collected facing upstream to avoid stirring up any sediment in the soil. Hitting the bottom with the bottle probably cannot be avoided, so lower the bottle slowly into the water to minimize the disturbance.

Samples bottles should be filled to the top. If possible, grab samples should be collected by completely submerging the bottle or container below the surface of the water to avoid collecting any material floating on the surface. When submerging the bottle, avoid hitting the bottom of the water body. Hitting the bottom may disturb the sediment and impact the sample.

As mentioned earlier, intermediate containers can be used to collect certain samples. This intermediate sample is then poured immediately into the appropriate grab sample bottle(s). Intermediate sample bottles are used to collect a series of small samples that are used to fill a single sample bottle. **When transferring the sample from the intermediate container to the bottle, it is very important that the sediment be kept in suspension by stirring or swirling the container. Otherwise a portion of the sediment may settle out in the intermediate container and not be included in the sample that will be analyzed.**

Each bottle should be rinsed out at least once with a small amount of the source water before taking the actual sample. This same procedure should be followed when using an intermediate container to fill a bottle. Both the container and bottle should be rinsed.

The bottle should be opened at the last possible moment and the lid screwed back on immediately after the sample is collected. The lid should be handled carefully during this time to avoid contaminating the inner lining. Hold the lid around the rim and face it down. If possible open and close the bottle under water when collecting a sample.

Sampling locations may vary with each event depending on the location of a breach or storage yard. Sampling crews should be prepared to modify sampling locations or points in order to maximize the representativeness of the samples. Detailed field notes and or photographs should be used to document the conditions and reasons for selecting a specific location to collect a sample.

Information regarding the final sampling locations selected for the event and the actual sample collection should all be documented in the Sampling Activity Logs. Photographs are helpful to show the discharge(s), instream conditions, run-on flows, and sample collection methods.

Sample Preservation. All samples are kept on ice or refrigerated to 4 degrees Celsius from the time of sample collection until delivery to the analytical laboratory. The grab samples are placed in an ice chest with ice immediately following collection. In addition to keeping the samples cool it is also important to minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample, resulting in unreliable analytical results. Therefore, all samples are covered or placed in an ice chest with a closed lid immediately following collection.

Sample bottles for nutrients, metals, and some volatile organics may contain acid or other chemical preservatives. Laboratories clearly mark each bottle if it contains a preservative. Normally the volume added is very small, such as 1 or 2 milliliters, so the actual preservative may be hard to see. **Do not rinse or over fill sample bottles**

that contain a preservative. Use an intermediate container to carefully fill the bottle. Do not submerge the bottle in the flow. Rinsing and overfilling the bottle may flush out the preservative or dilute it to the point where it will no longer be effective.

Be careful when handling bottles that contain acid. Spilling the acid can cause burns to the skin and eyes or damage clothes. Flush the area with water, even runoff, if an open bottle containing an acid preservative is accidentally spilled.

Sample Delivery/Chain of Custody. All samples must be kept on ice, or refrigerated, from the time of onset of sample collection to the time of receipt by laboratory personnel. If samples are being shipped to the laboratory, place sample bottles inside coolers with ice, ensure that the sample bottles are well packaged, and secure cooler lids with packaging tape. It is imperative that all samples be delivered to the analytical laboratory and analysis begun within the maximum holding times specified by laboratory analytical methods (see Section 3.3.5). The holding times for the water quality indicators range from six hours to 28 days. To minimize the risk of exceeding the holding times for bacteria (6 hours), BOD (48 hours), and metals (48 hours), samples must be transferred to the analytical laboratory as soon as possible after sampling. The sampling crew must in such cases coordinate activities with the analytical laboratory to ensure that holding times can be met.

Chain-of-custody (COC) forms are to be filled out by the sampling crew for all samples submitted to the analytical laboratory. The purpose of COC forms is to keep a record of the transfer of sample custody, and requested analyses. Sample date, sample location, and analysis requested are noted on each COC.

Any special instructions for the laboratory should also be noted, such as specifications of lab quality control requirements (e.g., laboratory duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) samples).

Copies of COC forms are kept with field notes in a field logbook. COC forms should be checked to be sure all analyses specified by the sampling plan are included. Review of the COC forms immediately following a storm event gives the data reviewer a chance to review the sampling crews' requests and then to notify the laboratory of additional analyses or necessary clarification. An example of a customized COC form is presented in Section 4.2.

3.3.4 Quality Assurance/Quality Control (QA/QC)

The quality of analytical data is dependent on the ways in which samples are collected, handled and analyzed. Procedures for both field and laboratory measures should be included in the SAP to maximize the data's quality and usefulness. The information presented in this section was adapted from Section 11 of the *Department's Guidance Manual: Stormwater Monitoring Protocols (Second Edition)*.

Improved control of data quality is achieved by incorporating the following elements within the sample collection effort:

- Duplicate Samples
- Blank Samples
- Matrix Spikes/Matrix Spike Duplicate Samples
- QC Sample Schedule

Each of these types of samples and the relevant responsibilities of monitoring field personnel are described below, followed by a discussion of recommended minimum frequencies for the various types of QC samples. The results of the field QC samples are then used to evaluate the quality of the reported data (data evaluation is discussed in Section 3.3.6).

Duplicate Samples
Analytical precision is a measure of the reproducibility of data and is assessed by analyzing two samples that are intended to be identical. Any significant differences between the samples indicate an unaccounted-for factor or a source of bias. There are typically two types of duplicate samples that require special sampling considerations: field duplicates and laboratory duplicates. Duplicates should be evaluated for all analytical samples to be performed during the non-visible pollutant monitoring.

<u>Field Duplicates.</u> Field duplicates are used to assess variability attributable to collection procedures. For grab samples, duplicate samples are collected by simultaneously filling two grab sample bottles at the same location. If intermediate containers are used, first pour an incremental amount into one sample bottle and then pour a similar amount into the second. Continue going back and forth until both bottles are full. Field duplicate samples should be submitted to the laboratory "blind" (i.e. not identified as a QC sample, but labeled with a different site identification than the regular sample). Field measurements should also be performed on duplicate samples but it will not be a blind test. Still, the results will indicate variability in the sampling and analysis. A field duplicate sample should be collected once every ten samples collected at a given sampling location or once per sampling station per project, whichever is more frequent

<u>Laboratory Duplicates.</u> Laboratory duplicates (also called laboratory splits) are used to assess the precision of the analytical method and laboratory handling. For the laboratory duplicate analysis the analytical laboratory will split one sample into two portions and analyze reach one. When collecting samples to be analyzed for laboratory duplicates, typically double the normal sample volume is required. This requires filling a larger size sample bottle, or filling two normal size sample bottles, labeling one with the site name and the second with the site name plus “laboratory duplicate”. Laboratory duplicate samples are collected, handled, and delivered to the

analytical laboratory in the same manner as environmental samples. Enough extra sample volume for the laboratory to create a duplicate should be collected once every ten samples collected at a given sampling location or once per sampling station per project, whichever is more frequent

Blank Samples
Contamination is assessed using blank samples to identify sources of contamination. Blanks are prepared to identify potential sample contamination occurring during field collection, handling, shipment, storage, and laboratory handling and analysis. Blanks are evaluated during various stages of the sampling and analytical process to determine the level of contamination, if any, introduced at each step. The collection and uses of the types of blank samples associated with typical stormwater monitoring field procedures are described below. "Blank water" refers to contaminant-free water provided by the laboratory performing the environmental and blank analyses. Typically, this water is the laboratory's reagent water that is used in the analytical or cleaning processes, as well as for their method blanks. The analytical laboratory should be consulted when selecting the source of the blank water.

Equipment Blanks. **Equipment blanks are typically used only when samples are being collected for metals, nitrates, and organic contaminates such as pesticides, herbicides, PAHs, organic carbon, and phthalate compounds.** Before using sampling equipment for sample collection activities, blanks should be collected to verify that the equipment is not a source of sample contamination. The non-visible pollutant monitoring program normally includes equipment blanks to check sample bottles and intermediate containers. To account for any contamination introduced by sampling containers, blanks must be collected for laboratory bottles used for sample storage. A sampling container blank is prepared by filling a clean container with blank water. The concentrations of the specific parameters of concern are then measured. These blanks may be submitted "blind" to the laboratory by field personnel or prepared internally by the laboratory.

Collection of sample container blanks may not be required if certified pre-cleaned bottles are used. The manufacturer can provide certification forms that document the concentration to which the bottles are "contaminant-free"; these concentrations should be equivalent to or less than the program reporting limits. If the certification level is above the program reporting limits, 2% of the bottles in a "lot" or "batch" should be blanked at the program detection limits with a minimum frequency of one bottle per batch.

Field Blanks. **Field blanks are typically used only when samples are being collected for metals, nitrates, and organic contaminates such as pesticides, herbicides, PAHs, organic carbon, and phthalate compounds.** Field blanks are necessary to evaluate whether contamination is introduced during field sampling activities. Field blanks are prepared by the sampling crew, under normal sample collection conditions, at some time during the collection of normal samples. Field blanks are prepared by filling a large carboy or other appropriate container with blank water, transporting the container to the field and processing the water through the same sampling procedures to be used for sample collection. Grab sample field blanks should be prepared by pouring a sample directly from the bottle of blank water, into the grab sample containers. Grab sample blanking should imitate environmental sampling as closely as possible by using clean intermediate containers, and other clean equipment in the same manner. The filled blank sample bottles should be sealed and sent to the laboratory to be analyzed for the required constituents.

It is important that field blanks are collected at a frequency no less than once per field sampling crew per sampling season. Additional blanks should be collected when there is a change in sampling personnel, equipment, or procedures. It may also be desirable to prepare field blanks prior to any actual sampling events as an advance check of the overall sampling procedures.

<u>Trip Blanks.</u> **Trip blanks are typically used only when samples are being collected for volatile organic compounds (VOCs).** Trip blanks are used to determine whether sample contamination is introduced during sample transportation and delivery. Trip blanks are prepared at the analytical laboratory, by filling the sample bottle with blank water and securing the bottle lid. Trip blanks are transported to and from the sampling station with normal sample bottles. Trip blanks are analyzed like normal samples.

<u>Method Blanks.</u> For each batch of samples, method blanks (also called control blanks) should be run by the laboratory to determine the level of contamination associated with laboratory reagents and glassware. The laboratory prepares method blanks by analysis of laboratory reagent or blank water. Results of the method blank analysis should be reported with the sample results. At a minimum, the laboratory should report method blanks at a frequency of 5% (one method blank with each batch of up to 20 samples).

Matrix spike (MS) and matrix spike duplicate (MSD)
MS and MSD analyses are typically used only when samples are being collected for metals, nutrients, and organics. MS/MSD analyses are used to assess the accuracy (MS) and precision (MSD) of the analytical methods in the sample matrix. The analytical laboratory prepares matrix spike samples by splitting off three aliquots of the environmental sample and adding known amounts of target analytes to two of the three environmental sample aliquots. The results of the analysis of the unspiked environmental sample are compared to the MS analysis results, and "percent recovery" of each spike is calculated to determine the accuracy of the analysis. The results of the MS analyses are compared to calculate relative percent difference (RPD) as an additional measure of analytical precision. When collecting samples to be specified for MS/MSD analysis, typically triple the normal sample volume is required. This will require filling a larger size sample bottle, or filling three normal size sample bottles, labeling one with the site name and the other two with the site

name plus "MS/MSD". MS/MSD samples are collected, handled, and delivered to the analytical laboratory in the same manner as environmental samples. Analytical laboratories often will perform MS/MSD analyses at no charge on a specified sample when a certain minimum number of samples are submitted for analysis.

QC Sample Schedule

Table 3-3 summarizes the minimum frequencies of QC sample collection/preparation for the Department's storm water monitoring programs based on EPA Guidance (EPA, 1995). These frequencies are minimal and may be increased depending on the nature and objectives of the study being undertaken or if QA/QC problems (e.g. contamination) are discovered.

A QC sample schedule should be developed, included in the SAP, and followed closely by field personnel. The project QC sample schedule should meet the minimum QC sample frequency criteria over the term of the project.

Table 3-3
Recommended QC Sample Frequency

QA/QC Sample Type Minimum	Sampling Frequency	Constituent Class
Field Duplicate	Once every ten samples collected at a given site or once per sampling station per project, whichever is more frequent.	All
Lab Duplicate	Once every ten samples collected at a given site or once per sampling station per project, whichever is more frequent.	All
Equipment Blank	Sample bottles should be blanked every batch [2]; or manufacturer or laboratory-certified to concentrations below the reporting limits used for the sampling program.	Metals and other common organic contaminants. [1]
Field Blank	Once every ten samples collected at a given site or once per sampling station per project, whichever is more frequent.	Metals and other common organic contaminants. [1]
Trip Blanks	Once every three trips to a given site or once per sampling station per project, whichever is more frequent.	VOCs
Method Blanks	Performed by lab as part of their internal QA/QC program	All
Matrix Spike/Matrix Spike Duplicate	Once every ten samples collected at a given site or once per sampling station per project, whichever is more frequent.	Metals and other common organic contaminants. [1]

Notes:
[1] Other common contaminants include phthalate compounds, pesticides, and organic carbon (TOC and DOC), nitrate as N, and PAHs. Analyze blanks for these constituents as appropriate for constituents monitored in specific projects.
[2] A batch is defined as the group of bottles that has been cleaned at the same time, in the same manner; or, if decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles.

3.3.5 Laboratory Sample Preparation and Analytical Methods

This section describes the steps to be taken by analytical laboratories to prepare for monitoring events, and the procedures laboratories will use for sample analyses. The following topics are discussed:

- Laboratory Selection and Contracting
- Pre-Sampling Preparations
- Sample Storage and Handling Prior to Analysis
- Reporting Limit Requirements
- Analytical Methods
- Laboratory Data Package Deliverables

Samples will be analyzed for one or more of the constituents presented in Table 3-4. Required analytical method, sample bottle type, target reporting limit, volume required for analysis, sample preservation, and maximum holding time are also presented in Table 3-4. The importance of these elements is incorporated into many of the following discussions.

Laboratory Selection and Contracting. Important considerations in selecting an analytical laboratory include location, past performance, ability to meet analytical reporting limits (RLs), and experience with the type of samples that will be generated by the monitoring program. Department of Health Services (DHS) certification is required for the Department's analytical work. A list of State-certified laboratories that are approved by the Department is available at the following Internet site: http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm.

Pre-Sampling Preparations. The analytical laboratory will be involved in a number of activities prior to the actual analysis of samples, including:

- Determination of key laboratory performance requirements (e.g., maximum reporting limits, turnaround times, report formats) for analytical services contract.
- Review and comment on the data quality evaluation procedures, QC sample schedule, and QC sample volumes.
- Providing sampling crew with clean sample containers and other equipment.
- Coordination with sampling crew prior to each anticipated storm-sampling event including number of samples anticipated, approximate date and time of sampling (if known), and when sample containers will be required

Table 3-4
Sample Collection, Preservation and Analysis for Monitoring Indicators of Non-Visible Pollutants

Constituent	Analytical Method	Sample Preservation	Minimum Sample Volume	Sample Bottle	Maximum Holding Time	Reporting Limit	Estimated Lab Cost
VOCs-Solvents	EPA 8260B	Store at 4˚ C, HCl to pH<2	3 x 40 mL	VOA-glass	14 days	1 µg/L	$ 120
SVOCs	EPA 8270C	Store at 4˚ C	1 L	Glass-Amber	7 days	10 µg/L	$ 275
Phenols	EPA 420.1	Store at 4˚ C, H_2SO_4 to pH<2	500 mL	Glass-Amber	28 days	0.1 mg/L	$ 35
Pesticides/PCBs	EPA 8081A/8082	Store at 4˚ C	1 L	Glass-Amber	7 days	0.1 µg/L	$ 140
Herbicides	EPA 8151A	Store at 4˚ C	1 L	Glass-Amber	7 days	Check Lab	$ 150
Residual chlorine	SM 4500	Do not expose to light	500 mL	Glass or PE	Immediate	0.1 mg/L	$ 10
Cations (barium, potassium, calcium, iron, sodium, magnesium)	EPA 200.7	Store at 4˚ C	500 mL	Glass or PE	6 months	1 mg/L	$ 75
Anions (chloride, sulfate))	EPA 300	Store at 4˚ C	500 mL	PE	28 days	1 mg/L	$ 45
TDS	EPA 160.1	Store at 4˚ C	100 mL	Glass or PE	7 days	1 mg/L	$ 15
BOD	EPA 405.1	Store at 4˚ C	500 mL	Glass or PE	48 hours	1 mg/L	$ 45
COD	EPA 410.1	Store at 4˚ C, H_2SO_4 to pH<2	100 mL	Glass or PE	28 days	10 mg/L	$ 30
TOC /DOC	EPA 415.1	Store at 4˚ C, H_2SO_4 to pH<2	100 mL	Glass or PE	28 days	1 mg/L	$ 70
TKN (organic nitrogen)	EPA 351.3	Store at 4˚ C, H_2SO_4 to pH<2	100 mL	Glass or PE	28 days	0.1 mg/L	$ 40
NO_3-N (nitrate – inorganic nitrogen)	EPA 300.0	Store at 4˚ C, H_2SO_4 to pH<2	100 mL	Glass or PE	48 hours	0.1 mg/L	$ 30
Phosphate (inorganic phosphorus)	EPA 300	Store at 4˚ C	100 mL	Glass or PE	48 hours	0.1 mg/L	$ 30
pH	EPA 150.1	None	100 mL	Glass or PE	Immediate	0.01 pH units	$ 10
Alkalinity	SM 2320B	Store at 4˚ C	250 mL	Glass or PE	14 days	1 mg/L	$ 20
Metals (Al, Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Tl, V, Zn)	EPA 200.8	Store at 4˚ C, HNO_3 to pH<2	250 mL	Borosilicate glass or PE	6 months	0.2 - 5 µg/L	$ 150
Metals (Chromium VI)	EPA 7199	Store at 4˚ C	500 mL	Borosilicate glass or PE	24 hours	1 µg/L	$ 50
Coliform bacteria (total/fecal)	SM 9221B/9221E	Store at 4˚ C, sodium thiosulfate in presence of chlorine	200 mL	Sterile glass or plastic	6 hours	1 MPN/100 mL	$ 60

Notes: Adapted from Attachment S of the SWPPP/WPCP Preparation Manual (March 2003) and Department's Guidance Manual: Stormwater Monitoring Protocols (Caltrans July 2000)

°C	–	Degrees Celsius	µg/L	–	Micrograms per Liter
BOD	–	Biochemical Oxygen Demand	mL	–	Milliliter
PE	–	Polyethylene plastic	PCB	–	Polychlorinated Biphenyl
EPA	–	Environmental Protection Agency	SM	–	Standard Method
HCl	–	Hydrogen Chloride	VOC	–	Volatile Organic Compound
H_2SO_4	–	Hydrogen Sulfide	HNO_3	–	Nitric Acid
L	–	Liter	mg/L	–	Milligrams per Liter
SVOC	–	Semi-Volatile Organic Compound	MPN	–	most probable number
TKN	–	total Kjeldahl nitrogen	COD	–	chemical oxygen demand
TOC	–	total organic carbon	DOC	–	dissolved organic carbon

Sample Storage and Handling Prior to Analysis. To minimize the chance of sample contamination and unreliable analytical results, special measures must be taken during the storage and handling of samples prior to analysis. For example, samples must be collected and stored in the appropriate containers and preserved. Samples must be analyzed within established holding times to ensure reliability of the results.

Maximum acceptable holding times are method-specified for various analytical methods. **The holding time starts for each individual grab sample when it is collected and the time is counted until analysis of the sample.** If a sample is not analyzed within the designated holding times, the analytical results may be suspect. Thus, it is important that the laboratories meet all specified holding times and makes every effort to prepare and analyze the samples as soon as possible after they are received. Prompt analysis also allows the laboratory time to review the data and, if analytical problems are found, re-analyze the affected samples.

Reporting Limit Requirements. The reporting limit (RL) is the minimum concentration at which the analytical laboratory can reliably report detectable values. It is important to ensure that the RLs derived for the project are low enough to provide useful results. The RLs listed in Table 3-4 match the RLs required by the Department in the *Stormwater Monitoring Protocols Guidance Manual*.

If the project is considering the use of field test kits or electronic meters, reporting limits these devices can achieve need to be checked against the limits in Table 3-4.

Analytical Methods. The recommended analytical methods are shown in Table 3-4. All of these methods are described either in "Standard Methods for the Examination of Water and Wastewater or in the listed EPA method.

Laboratory Data Package Deliverables. As a part of the laboratory contract, the data package that will be delivered to contractor and the timing of its delivery (turn around time) should be defined. The data package should be delivered in hard copy and electronic copy (on diskette).

The hard copy data package should include a narrative that outlines any problems, corrections, anomalies, and conclusions, as well as completed chain of custody documentation. A summary of the following QA/QC elements must be in the data package: sample analysis dates, results of method blanks, summary of analytical accuracy (matrix spike compound recoveries, blank spike compound recoveries, surrogate compound recoveries), summary of analytical precision (comparison of laboratory split results and matrix spike duplicate results, expressed as relative percent difference), and reporting limits. Because the laboratory must keep the backup documentation (raw data) for all data packages, raw data (often called Contract Laboratory Program (CLP) data packages) should not be requested.

In addition to the hard copy, an electronic copy of the data can be requested from the laboratory. The electronic copy includes all the information found in the hard copy data package. Data should be reported in a standardized electronic format.

Common turn around times for laboratory data packages are two to three weeks for faxed data and three weeks to thirty days for hard copy and electronic copy. Receiving the faxed data quickly allows an early data review to identify any problems that may be corrected through sample re-analysis.

3.3.6 QA/QC Data Evaluation

Laboratory Data Screening. When the laboratory reports are received following each sampling event, it is important to check the reported data as soon as possible to identify errors committed in sampling, analysis or reporting. The laboratory must report results in a timely fashion (as defined in the contractor's contract with the laboratory) and the results must then be reviewed immediately upon receipt. This may allow for re-analysis of questionable (out-of-range) results within the prescribed holding time. The initial screening includes the following checks:

- Completeness. The chain of custody forms should be checked to ensure that all laboratory analyses specified in the sampling plan were requested. The laboratory reports should also be checked to ensure that all laboratory analyses are performed as specified on the chain of custody forms, including the requested QA/QC analyses.

- Holding Time. The lab reports need to be checked to verify that all analyses were performed within the prescribed holding times.

- Reporting Limits. The reported analytical limits should meet or be lower than the levels agreed upon prior to laboratory submission.

Reporting Errors. On occasion laboratories commit typographical errors or send incomplete results. Reported concentrations that appear out of range or inconsistent are indicators of potential laboratory reporting problems, and should be investigated when detected. Examples of this would be a reported value that is an order of magnitude different than levels reported for the same constituent for other events.

Irregularities found in the initial screening should immediately be reported to the laboratory for clarification or correction. This process can identify and correct errors that would otherwise cause problems further along in the data evaluation process, or in subsequent uses of the data for higher-level analysis. When appropriate, reanalysis of out-of-range values can increase confidence in the integrity of questionable data.

The laboratory data can also be screened using the Department's Stormwater Management Program Laboratory Electronic Data Delivery (EDD) Error Checker. The laboratory will need to be trained to use the tool and report the data in a standard electronic format.

Laboratory Data Validation. The data quality evaluation process is structured to provide checks to ensure that the reported data accurately represented the concentrations of constituents actually present in water quality samples. Data evaluation can often identify sources of contamination in the sampling and analytical processes, as well as detect deficiencies in the laboratory analyses or errors in data reporting. Data quality evaluation allows monitoring data to be used in the proper contest with the appropriate level of confidence.

QA/QC parameters that should be reviewed are classified into the following categories:

(1) Contamination check results (method, field, and equipment blanks)

(2) Precision analysis results (laboratory, field, and matrix spike duplicates)

(3) Accuracy analysis results (matrix spikes and laboratory control samples)

Each of these QA/QC parameters should be compared to the data quality objectives listed in Table 3-5. The key steps in the analysis of each of these QA/QC parameters are:

(1) Compile a complete set of the QA/QC results for the parameter being analyzed.

(2) Compare the laboratory QA/QC results to accepted criteria.

(3) Compile any out-of-range values and report them to the laboratory for verification.

(4) Attach appropriate qualifiers to data that do not meet QA/QC acceptance criteria.

(5) Prepare a report that tabulates the success rate for each QA/QC parameter analyzed.

Refer to Section 13 of the Department's *Stormwater Monitoring Protocols Guidance Manual* provided in Appendix E for specific direction on evaluating the results of contamination, accuracy, and precision checks, and on qualifying data that do not meet data quality objectives.

The laboratory data can also be validated using the Department's Stormwater Management Program Laboratory EDD Error Checker. The data manager will need to be trained to use the tool.

Table 3-5
Control Limits for Precision and Accuracy for Water Samples

Constituent	Method	Maximum Allowable RPD	Recovery Lower Limit	Recovery Upper Limit
VOCs-Solvents	EPA 8260B		Constituent specific	
SVOCs	EPA 8270C		Constituent specific	
Phenols	EPA 420.1			
Pesticides/Herbicides	EPA 8081/8151A	25%	Constituent specific	
Residual chlorine	SM 4500			
TDS	EPA 160.1	20%	80%	120%
BOD	EPA 405.1; SM 5210B	20%	80%	120%
Total Phosphorus	EPA 365.3	20%	80%	120%
NH_3-N	EPA 350.3	20%	80%	120%
NO_3-N	EPA 300.0	20%	80%	120%
pH	EPA 150.1	20%	NA	NA
Alkalinity	SM2320B	20%	80%	120%
Phosphate	EPA 300			
MBAS (for surfactants)	EPA 425.1			
Metals	EPA 200 series	20%	75%	125%
Coliform bacteria	SM 9221B / 9221E	N/A	N/A	N/A

Notes: RPD = relative percent difference between duplicate analyses.
Recovery, lower and upper limits refer to analysis of spiked samples.

Field Data Screening and Validation. When the field data sheets are received following each sampling event, it is important to check the reported data as soon as possible to identify errors committed in sampling or reporting. The WPCM must report results in a timely fashion (i.e., within 5 days of the sampling event) and the results must then be reviewed immediately upon receipt. The initial screening includes the following checks:

- Completeness. The field sheets should be checked to ensure that all field tests and measurements specified in the sampling plan were performed, including the requested QA/QC analyses.

- Reporting Errors. On occasion sampling crews commit typographical errors. Reported values that appear out of range or inconsistent are indicators of potential field reporting or equipment problems, and should be investigated when detected.

Irregularities found in the initial screening should immediately be reported to the sampling crews for clarification or correction. This process can identify and correct errors that would otherwise cause problems further along in the data evaluation process, or in subsequent uses of the data for higher-level analysis.

Field QA/QC parameters that should be reviewed are classified into the following categories:

(1) Precision analysis results (field duplicates)

(2) Accuracy analysis results (equipment calibration)

Each of these field QA/QC parameters should be compared to the data quality objectives established for the study. The key steps in the analysis of each of these field QA/QC parameters are:

(1) Compile a complete set of the QA/QC results for the parameter being analyzed.

(2) Compare the field QA/QC results to accepted criteria.

(3) Compile any out-of-range values and report them to the sampling crew for verification.

(4) Attach appropriate qualifiers to data that do not meet QA/QC acceptance criteria.

(5) Prepare a report that tabulates the success rate for each QA/QC parameter analyzed.

Refer to Section 13 of the Department's *Stormwater Monitoring Protocols Guidance Manual* provided in Appendix E for specific direction on evaluating the results of contamination, accuracy, and precision checks, and on qualifying data that do not meet data quality objectives.

3.3.7 Data Management and Reporting

To facilitate data management, analysis, and the comparison of results, a standard system for data reporting should be developed for the project. Both electronic and hardcopy data must be filed in Category 20 of the project files in an organized and easily accessible fashion.

To keep the data organized, each monitoring site, station, and sampling event should be assigned a unique identification number. All the data should be organized and associated with these numbers.

The SPs require the results of field analyses must be submitted to the resident engineer within five (5) days of taking the measurement. Results from laboratory analyses must be submitted within 30 days of collecting the samples. QA/QC data must accompany the field and or analytical data.

Attribute date should also be collected to assist with interpreting the data. The attribute data usually describes the sample, event, and site. The sample description may provide information on the sample itself: when and how it was collected, what it was analyzed for, the method and lab used to perform the analysis, and the result of the analysis. This section also can characterize the sample source, as well as the portion of a rain event that is represented by the sample.

The event information describes the discharge event itself. This includes when the rain started and stopped, when runoff started and ended, when the discharge to the receiving stream started and ended, and antecedent dry days. Site description information span a range of categories from geographic information and boundaries, such as coordinates, hydrologic sub-area, land use, and size of the watershed, to political data like county, the Department, and RWQCB district.

All original data documented on sample bottle identification labels, Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. The project may want to consider reporting the electronic data in a format consistent with the Department's *2003-2004 Water Quality Data-Reporting Protocols* (November 2003).

3.4 Data Evaluation

The data will be evaluated to identify potential impacts on the receiving water quality caused by discharges of non-visible pollutants from the construction site and the conditions or areas on the construction site that may be the source of these pollutants in the runoff. The data involved in the evaluation include:

- Information gathered from the required site inspections before, during, and after storm events
- Sampling results from test and control sites on the construction site
- Sampling results of runoff that enters the construction site from areas upstream of the site

The control sample, which may not be completely representative of pre-construction levels, provides a basis for comparison with the test sample. The results of the test sample will be evaluated to determine if the constituent of concern is different than the levels found in the control sample. If substantial changes in the water quality of the runoff are identified, additional BMPs must be implemented in an iterative manner to prevent a net increase in pollutants to receiving waters.

The run-on sample analytical results will be used as an aid in evaluating potential offsite influences on water quality results. The result from any run-on samples need to be evaluated to determine if the run-on is contributing to concentration changes in the pollutant of concern. Sample results of the run-on discharges may demonstrate similar concentration changes. If different levels are found, the run-on should be included in the source identification process.

This evaluation will be performed for every discharge event that samples are collected. Results of the evaluation, including figures with sample locations, will be submitted to the resident engineer along with the water quality analytical results and the QA/QC data. Should the concentrations in the test sample be substantially different than the control sample, site personnel will evaluate the BMPs, site conditions, surrounding influences (including run-on sample analysis), and other site factors to determine the probable cause for the change. As determined by the data and project evaluation, appropriate BMPs will be repaired or modified to mitigate increases in non-visible pollutant concentrations in the runoff. Any revisions to the BMPs will be recorded as an amendment to the SWPPP.

3.4.1 Identifying Water Quality Impacts

To identify substantial changes of non-visible pollutant in the runoff, the percent difference between the control data and test data are calculated for the constituents of concern. The percent difference is calculated using the following formula:

$$(\text{Control result} - \text{Test result}) / \text{Control result} * 100$$

Remember, field measurements may be collected at the control and test locations during each event because of potential variability in the water quality. All measurements for a given sampling location should be averaged together. This mean or average value is used in the calculations.

If any of the results are reported as non-detects (ND), a value of one-half the reporting limit (RL) should be used.

A difference between the control and test concentrations greater than plus/minus 25 percent (±25%) indicates an impact from a non-visible pollutant. Twenty-five percent has been selected to represent a substantial change in water quality.

To identify contributions of any run-on, the percent difference can be calculated between the run-on quality and both the control and test data for the constituents of concern. The percent difference is calculated using the following formulas:

$$(\text{Control result} - \text{Run-on result}) / \text{Control result} * 100$$

$$(\text{Test result} - \text{Run-on result}) / \text{Test result} * 100$$

Once again, if any of the results are reported as non-detects (ND), a value of one-half the reporting limit (RL) should be used.

A difference between the run-on and either the control or test concentrations greater than plus/minus 25 percent (±25%) may indicate the run-on could be a source.

3.4.2 Assessing the Need for Corrective Measures

If a comparison of the control and test samples indicates a water quality impact from a non-visible pollutant has occurred, the source needs to be identified and corrective measures identified. Information gathered from the required site inspections before, during, and after storm events will be used to identify the source(s).

If the source of the discharge is run-on to the construction site, the levels of pollutants from run-on samples should be evaluated. Substantial differences in the concentrations will indicate that the sources outside of the construction site may be a pollutant source. The identification of adjacent landowner discharges should be included in the Notice of Potential Non-Compliance and other BMP measures as the first step to remove pollutants from run-on.

Possible solutions may include repairing the existing BMPs, evaluating alternative BMPs that could be implemented, and/or implementing additional BMPs (cover and/or containment) which further limit or eliminate contact between storm water and non-visible pollutant sources at the site. Where contact cannot be reduced or eliminated, storm water that has come in contact with the non-visible pollutant source should be retained on-site and not discharged to a storm drainage system or a water body (SWQTF 2001).

3.4.3 Implementing Corrective Measures

If the construction site is found to be contributing non-visible pollutants to the runoff, the following steps should be taken as soon as possible:

(1) Identify the source

(2) Repair or replace any BMP that has failed or cleanup any spilled non-visible pollutants.

(3) If there are elevated levels in run-on, notify upgradient sources and RWQCB.

(4) Maintain any BMP that is not functioning properly due to lack of maintenance

(5) Evaluate whether additional or alternative BMPs should be implemented.

If sampling and analysis during subsequent storm events shows that there is still a problem, then repeat the steps above until the analytical results of upstream and downstream samples are relatively comparable (SWQTF 2001).

3.4.4 Reporting Non-Compliance

Reporting requirements are discussed in section C-2, Receiving Water Limitations for Construction Activities, of the Department's General Permit. Should the data and evaluations indicate storm water and/or authorized non-storm water discharges are substantially different from the control site and could potentially cause or contribute to a negative impact in a water body, the following shall occur:

(1) The contractor shall notify the resident engineer verbally within 48 hours of the identification that a discharge occurred. The Department shall notify the RWQCB by telephone within 48 hours of a discharge that a discharge occurred.

(2) A Notice of Discharge will follow verbal notification to the RE and a Notice of Potential Non-compliance to the RWQCB. These reports will include:

   a) The nature and case of the water quality standard exceedance

   b) The BMPs currently being implemented

   c) Corrective actions performed or to be performed to reduce the pollutant loads including any maintenance or repair of BMPS

   d) Additional BMPs which will be implemented to prevent or reduce pollutants that are causing or contributing to the exceedance of water quality standards

   e) Implementation schedule for corrective actions

   The contractor shall submit a Notice of Discharge pursuant to Section 600. 2 of the SWPPP to the resident engineer within 7 days. The Department shall submit a report of Potential Non-compliance to the RWQCB within thirty days.

(3) Amend the SWPPP and monitoring program for the construction site to reflect any additional BMPs that have been and will be implemented, the implementation schedule, and additional monitoring requirements.

Section 4
Model Sampling and Analysis Plans

Two model Sampling and Analysis Plans (SAPs) are presented in this section. The first model is for a SAP that covers a sedimentation/siltation sampling program. The second model is for a SAP that covers a non-visible pollutant sampling program.

Both models are based on the templates found in Section 600 of the *SWPPP/WPCP Preparation Manual* (March 2003) and the two SWPPP models prepared by the Department. The intent of these models is to provide examples of the format to follow and the required information, text, tables, and graphics to implement the sampling program at a specific construction site. Each construction site will have a unique set of features and sampling requirements. All SAPs will include a standard set of sections and information requirements as presented in Sections 2.2.1 and 3.2.1, but each SAP will also need to be tailored to its specific site and sampling strategy.

The SAP for sedimentation/siltation is presented in Section 4.1 and the SAP for non-visible pollutants is presented in Section 4.2.

4.1 Sediment/Siltation or Turbidity

This model is based on Section 600.4, Sampling and Analysis Plan for Sediment, from the *SWPPP/WPCP Preparation Manual* (March 2003). It has used the model SWPPP for Route BB, assuming that Coyote Creek has been listed as impaired for sedimentation/ siltation on the State's 303(d) list of impaired water bodies. The model SAP with its associated WPCD maps is attached to this section.

The model Storm Water Pollution Prevention Plan (SWPPP) is for a hypothetical $15 million construction project of Route BB to construct 1.2 miles of new highway in the city of Anytown, California. The project includes significant earthwork operations and the construction of several retaining walls and soundwalls within the project limits. The project begins 0.1 mile north of Meadow Drive and terminates to 0.1 mile south of Cerritos Avenue. The project area is 100.3 acres (40.6 hectares) in size with an expected duration of approximately one year and seven months. The entire project area will be subject to soil-disturbing activity.

Although the full width improvements will tie into the existing Route BB at the north, the traffic will be transitioned off the highway and routed to existing Evelyn Road via the Monte Road southbound offramp. From the offramp to the southerly end of the project, improvements are to be constructed to accommodate the future extension of the highway.

The project will involve an Environmentally Sensitive Area (ESA) that will be protected from construction activity. The project provides for the construction of drainage facilities that collect and convey the majority of the storm water to the Coyote Creek Channel. The Coyote Creek Channel is a small concrete channel that flows to the north, and is subject to flooding. *(Again, the assumption has been made that Coyote Creek is a 303(d) listed water body for sedimentation/siltation for this model SAP.)*

The Contractor will have four yards: the main yard is located along the north side of Monte Road and east of Route BB; the others are located east of Route BB at the southernmost terminus of the project, along the north side of Charlie Avenue, and along the north side of John Avenue.

The SWPPP for this project requires two implementation stages as shown on the Water Pollution Control Drawings (WPCDs) in Attachment B of the model:

- Stage 1 is to be implemented at the start of the project and is to include the significant earth disturbing activities. The Best Management Practices (BMPs) for this stage include those necessary for clearing and grubbing, earthwork operations, rough grading of fill slopes, finish grading of cut slopes, and start of the structures work associated with the project, including the installation of the drainage system. The details for stage 1 of the program are shown on the WPCDs labeled as STAGE 1.

- Stage 2 is to be implemented at the completion of significant earthwork operations and allows for fine grading of fill slopes, completion of structures, paving operations, and installation of permanent BMPs such as landscape or irrigation. The details for stage 2 of the program are shown on the WPCDs labeled as STAGE 2.

The major Best Management Practice features include:

- Erosion control by scheduling, preserving the existing vegetation, mulching and/or applying soil stabilizers, installing fiber rolls, temporary seeding, plastic sheeting and slope drains.

- Sediment control using silt fencing, storm drain inlet protection, sediment traps, desilting basins, check dams, sweeping, and vacuuming.

- Sediment tracking will be controlled using stabilized construction entrances, and sweeping and vacuuming.

- Proper handling of concrete wastes, lubricants, fuels, hazardous wastes, and asphalt concrete will control non-storm water pollution, dewatering discharges and solid wastes.

Section 600.4
Sampling and Analysis Plan for Sediment

This project does have the potential to discharge directly to a water body listed as impaired due to Sedimentation/Siltation and/or Turbidity pursuant to Clean Water Act, Section 303(d).

600.4.1 Scope of Monitoring Activities

This project discharges directly into the Coyote Creek, a water body listed as impaired due to sedimentation/siltation pursuant to Clean Water Act, Section 303(d). This Sampling and Analysis Plan (SAP) has been prepared pursuant to the requirements of Resolution 2001-046, the Department's *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*, and the applicable sections of the Department's *Guidance Manual: Stormwater Monitoring Protocols* (Second Edition, July 2000). The SAP describes the sampling and analysis strategy and schedule for monitoring sediments and silts in Coyote Creek and potential increases in the sediment/silt levels caused by storm water discharges from the project site.

The project has the potential for direct (concentrated) storm water discharges to Coyote Creek at two locations identified on the WPCD-4 in Attachment B.

The project receives run-on at seven locations. This run-on has the potential to combine with storm water that discharges directly to Coyote Creek.

600.4.2 Monitoring Strategy

<u>Sampling Schedule</u>

Upstream, downstream, and run-on samples shall be collected for sediments/silts during the first two hours of discharge from rain events that result in a direct discharge from the project site to Coyote Creek. Samples shall be collected during daylight hours (sunrise to sunset) and shall be collected regardless of the time of the year, status of the construction site, or day of the week.

All storm events that generate discharges to Coyote Creek during daylight hours will be sampled up to a maximum of four rain events within a 30-day period. In conformance with the U.S. Environmental Protection Agency definition, a minimum of 72 hours of dry weather (less than 0.1 inches of rain) will be used to distinguish between separate rain events. If discharges begin at least two hours prior to sunrise and continue past daylight, no sampling will be performed.

<u>Sampling Locations</u>

Sampling locations are based on proximity to identified discharge or run-on location(s), accessibility for sampling, crewmember safety, and other factors in accordance with the applicable requirements in the Department's *Guidance Manual:*

Construction Site Storm Water Quality Sampling (December 2003) and the Department's *Guidance Manual: Stormwater Monitoring Protocols* (Second Edition, July 2000). All sampling locations are shown on the WPCDs and include:

- A sample location (designated number CCUP1) is upstream of all direct discharge from the construction site for the collection of a control sample to be analyzed for the prevailing condition of the receiving water without any influence from the construction site. The control sample will be used to determine the background levels of sediment/silt in Coyote Creek, upstream of the project. Refer to the location on the WPCDs in Appendix B.
  - Sample location identified as CCUP1 is located at the intersection of Griffith Road and an unidentified street on WPCD-5. It is located in the southeast quadrant of the intersection where a new entrance is being constructed.
- A sample location (designated number CCDN2) is downstream from the last point of direct discharge from the construction site for the collection of a sample to be analyzed for potential increases in sediment/silt in Coyote Creek caused by storm water discharges from the project, if any. Refer to the location on the WPCD-4 in Appendix B.
  - Sample location number CCDN2 is located where Coyote Creek leaves the Department's right of way, just north of Monte Road.
- Seven (7) sampling locations (designated as CCRO1-CCRO7) have been identified for the collection of samples of run-on to the Department's right-of-way. Samples from these seven stations will identify potential sediment/silt loads that originate off the project site and contribute to direct storm water discharges from the construction site to Coyote Creek. Their locations are identified on the WPCDs in Appendix B.

600.4.3 Monitoring Preparation

This section covers topics of training, and preparation and logistics. The information presented in this section was adapted from the Department's *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*, Section 2.3.

Training

All sampling crewmembers and alternates will receive training on the monitoring techniques and protocols specified in the SAP so water samples are collected in a manner that meets the goals of the plan, while protecting the health and safety of the sampling crew members. Field monitoring training will include the following basic elements:

- Review Sampling and Analysis Plan

- Review Health and Safety
- Training/Sampling Simulation (Dry Run)

Review SAP and Health & Safety. All the Contractor's sampling crewmembers and alternates will read the entire SAP developed for the construction site to obtain the background information required for an overall understanding of the project.

The Contractor's sampling crewmembers will be made aware of potential hazards associated with sampling. These hazards can include slippery conditions, cold or hot temperatures, open water that may be fast moving and or deep, construction site traffic, and contaminated water. Crewmembers need to become familiar with the methods to be employed to cope with those hazards.

Safety practices for sample collection will be in accordance with the *Roadway Construction, Inc. Health and Safety Plan*, dated November 2003. Several general procedures that must be followed at all times include:

- All sampling crewmembers must wear hard hats, traffic vests, and steel-toed boots when working outside the vehicle.
- Traffic control must be set up before conducting any work in the Department's right-of-way where crewmembers will be exposed to traffic. Standard traffic control measures include parking vehicles to shield crewmembers from traffic and using hazard lights.
- No sampling crewmember will enter Coyote Creek during a sampling event. A life ring and rope shall be present during all sampling events.
- Clean nitrile gloves will be worn by all sampling crewmembers when working with sampler bottles (empty and filled) and during grab sampling.
- All electronic equipment should be kept as dry as possible.
- Cell phones use shall be avoided or minimized while driving.

Sampling Simulation (Dry Run). A training session will be held for all of the Contractor's sampling crewmembers and alternates to review the sampling techniques and protocols specified in this SAP. The Contractor's training session will be organized in a chronological fashion, in order to follow the normal train of events from pre-monitoring preparations through post-monitoring activities. All standard operating procedures will be covered, along with the site-specific responsibilities of individual crewmembers.

The training will include a visit to the construction site where a sampling simulation, or "dry run," can be conducted under the supervision of the project manager or sampling crew leader. During the "dry run" sampling crewmembers travel to their assigned sampling locations and run through the procedures specified in the Sample Collection section of the SAP, including:

- Site access and parking at the site
- Traffic control measures (if any)
- Preparing the stations for monitoring
- Collecting water samples
- Completing sample labels, field log forms, and COCs
- Packing samples
- Delivering or shipping samples to the laboratory

Preparations and Logistics

Sample bottle ordering, bottle labels, field equipment maintenance, monitoring event selection criteria, weather tracking, and notification procedures are presented in this section.

Bottle Order. Prior to the first targeted storm and immediately after each monitored storm event, bottles for the next event must be ordered from the laboratory. Adequate grab sample bottles will be ordered for each of the monitoring stations, plus bottles for quality control samples. At least 20 1-liter polyethylene sample bottles and lids will be available for each event. The bottles are to be cleaned by the laboratory according to the methods specified in Appendix D of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*.

Sample Labels. Grab sample bottles shall be pre-labeled to the extent possible before each monitoring event. Pre-labeling sample bottles simplify field activities, leaving only date, time, sample number, and sampling crewmember names to be filled out in the field. Basic bottle labels are available pre-printed with space to pre-label by hand writing or typing. Custom bottle labels may be produced using blank labels, labeling software, and waterproof ink. The bottle label shall include the following information, with other items as appropriate:

Route BB - Sediment/Silt Monitoring Program
Coyote Creek

Date: ______________________________
Time: _____________________________
Station #: ___________________________
Collected by: ________________________

Sample ID: ____________________________(see below for sample code development)

Each sample bottle label shall include a sample identification code as shown below.

SSSSSYYMMDDHHmmTT

Where:

SSSSS	=	station number (CCUP1, CCDN2, CCRO1-CCRO7)
YY	=	last two digits of the year (01)
MM	=	month (01-12)
DD	=	day (01-31)
HH	=	hour sample collected (00-23)
mm	=	minute sample collected (00-59)
TT	=	Type or QA/QC Identifier (if applicable)
		G = grab
		FS = field duplicate

For a grab sample collected at Station CCUP1 collected at 4:15 PM on December 8, 2003, the sample number will be:

CCUP10312081615G

Sample labels will be placed on the bottle rather than the cap to identify the sample for laboratory analysis. Bottles shall be labeled in a dry environment prior to sampling crew mobilization. Attempting to apply labels to sample bottles after filling may cause problems, as labels usually do not adhere to wet bottles. Following labeling, clear scotch tape shall be applied over the label to prevent ink from smearing.

Field Equipment Maintenance. An adequate stock of supplies and equipment for monitoring sediment/silt will be available on the project site or provided by ABC Laboratories prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight.

Prior to the first targeted storm and immediately after each of the subsequent sampling events, sampling crew will inventory the field equipment shown in Figure 600-1. Field equipment shall be kept in one location, which is used as a staging area to simplify sampling crew mobilization.

Figure 600-1. Field Equipment Checklist

☐	First aid kit	☐	Sampling and Analysis plan
☐	Log books/log sheets	☐	Chain of Custody forms
☐	"Rite-n-Rain" pens	☐	Markers – fine point
☐	Paper towels	☐	Coolers and ice
☐	Required grab sample bottles	☐	Spare bottle labels
☐	Grab pole	☐	Intermediate container
☐	Weather –resistant camera	☐	Powder-free nitrile gloves
☐	Rubber bands / Duct tape	☐	Zip-lock baggies
☐	Cellular phone	☐	Hardhats / orange safety vests
☐	Personal rain gear	☐	Life ring with rope
☐	Health and Safety Plan	☐	Sand bags (6)

Weather Tracking. The Resident Engineer or Department inspector and the Water Pollution Control Manager (WPCM) or other assigned Contractor staff member will track weather conditions and potential storms. Weather will be tracked using a number of sources including local newspapers and TV news programs, the Weather Channel, the National Weather Service (NWS) at www.nws.noaa.gov, and other Internet sites for radar imagery and hourly weather observations from a network of surface weather monitoring stations throughout California.

Communications. A communication plan has been developed to clearly define lines of communication and notification responsibilities. The plan is shown in Figure 600-2. It will be used for sampling station and preparation activities, crewmember notification of forecasted events, communications during sampling, and coordinating site and BMP evaluations following an event. Emergency telephone numbers are listed, including numbers of hospitals nearest the construction site.

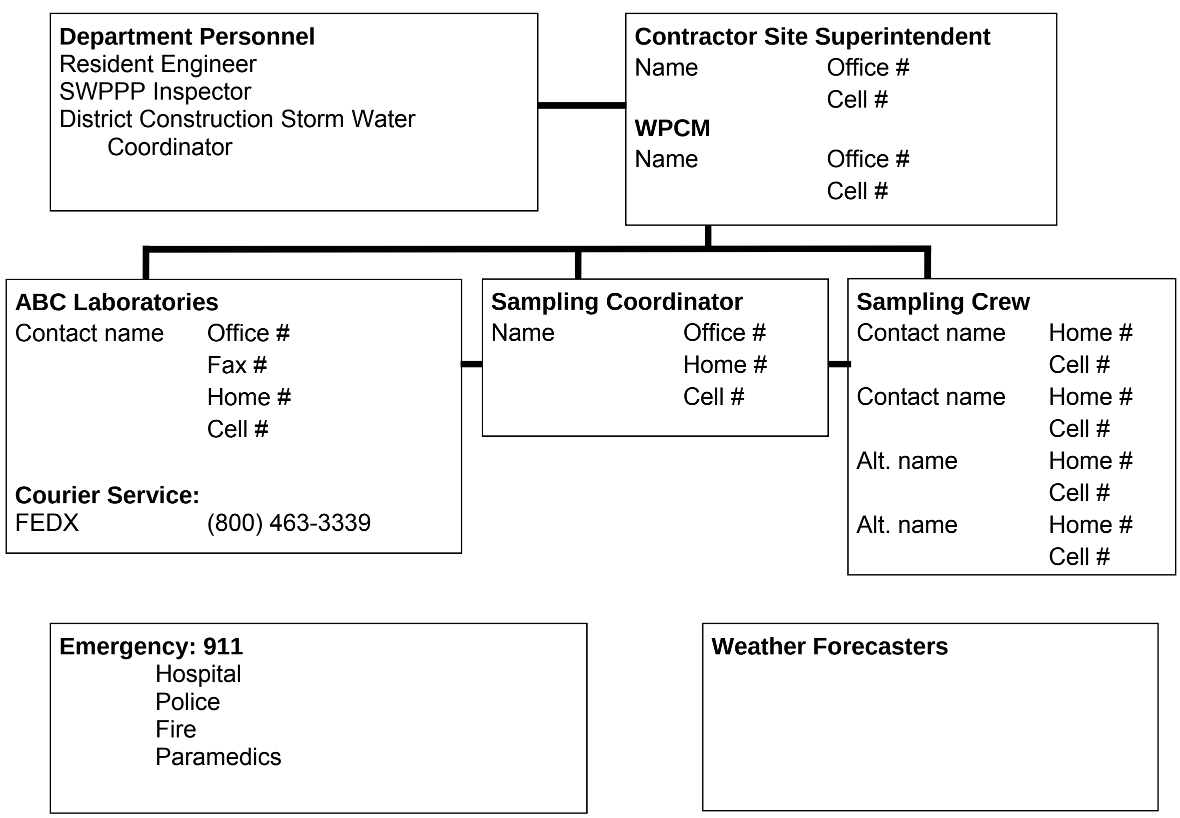
WPCM will begin to contact Sampling Coordinator and ABC Laboratories 48 hours prior to a predicted rain event to ensure that adequate number of sampling crewmembers, supplies, and field equipment for monitoring sediment/silt are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.

When first alerted, sampling crewmembers shall consult their sampling plan and check field equipment and supplies to ensure they are ready to conduct any sampling. Before arriving at the site, the sampling crew will need to obtain ice (for sample preservation). Ice for grab samples shall be kept in ice chests where full grab sample bottles will be placed. Keeping ice in zip-lock bags facilitates clean easy ice handling. Refreezable ice packets are generally not recommended because they are susceptible to leakage. If a discharge is observed, the sampling crewmembers will be ready to perform the required tasks within the first two hours of the discharge.

Personal Safety. Before samples are collected, crewmembers must ensure the safety of such activities at each sampling location. Personal safety shall be considered when selecting monitoring stations. Adherence to the following recommendations will minimize risks to sampling crewmembers:

- At no time during storm conditions or when significant flows are present shall sampling crewmembers enter Coyote Creek.
- Two-person sampling crews shall be available for all fieldwork to be conducted under adverse weather conditions, or whenever there are risks to personal safety.
- Crewmembers must be trained regarding appropriate on-site construction traffic control measures.

Figure 600-2. Communication Plan



600.4.4 Sample Collection and Handling

Sample Collection Procedures

Grab samples will be collected and preserved in accordance with the methods identified in Table 600-1, "Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation", provided in Section 600.4.5. Only crewmembers trained in proper water quality sampling will collect samples. Field activities shall be documented. Figures 600-3 and 600-4 present two examples of field forms that can be used to document all activities, samples, and observations.

Samples collected at Station CCUP1 will represent the condition of Coyote Creek prior to mixing with the discharges from the construction site. Samples collected at Station CCDN2 will represent the condition of Coyote Creek after mixing with the discharges from the construction site but no other discharge. Samples collected at Stations CCRO1-CCRO7 will identify potential sediment/silt that originates off the project site and contributes to direct discharges from the construction site to Coyote Creek.

Sampling Equipment and Bottles. It is important to use the appropriate sample bottles and equipment for each parameter to be measured (Refer to Table 600-1). Improper bottles and equipment can introduce contaminants and cause other errors, which can invalidate the data.

Immediately prior to the filling of grab sample bottles, the bottle labels shall be checked, and site- and event-specific information added using a waterproof pen. Attempting to label grab sample bottles after sample collection may be difficult because of wet labels.

Clean Sampling Techniques. All storm water quality sampling performed at Department construction sites shall employ "clean" sampling techniques to minimize potential sources of sample contamination. Care must be taken during all sampling operations to minimize exposure of the samples to human, atmospheric, and other potential sources of contamination. To reduce potential contamination, sample crewmembers must adhere to the following rules while collecting storm water samples:

- Always used laboratory cleaned sample bottles and intermediate containers
- No smoking
- Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
- Always wear clean, powder-free nitrile gloves when handling bottles, containers and lids

Figure 600-3. Sampling Activity Log Version 1

Coyote Creek – Route BB Storm Water Monitoring Field Form								
Date:				**Sampling Crew:**				
Arrival Time:				**Crew:**				
Description of Event-Specific Sampling Location (w/ photograph)								
CRUP1 -								
CRDN2 -								
CRRO1 -								
CRRO2 -								
CRRO3 -								
CRRO4 -								
CRRO5 -								
CRRO6 -								
CRRO7 -								
Sample Collection								
CRUP1			**CRDN2**			**Run-on**		
Sample #	**Date**	**Time**	**Sample #**	**Date**	**Time**	**Station #**	**Date**	**Time**
1			1			CRRO1		
2			2			CRRO2		
3			3			CRRO5		
4			4			CRRO4		
5			5			CRRO5		
						CRRO6		
						CRRO7		
Weather and Hydrology Data								
Rainfall start time:				**Duration:**		**Total Amount:**		
Discharge start time:				**Duration:**				
Run-on start time:				**Duration:**				
Notes:								

Figure 600-4. Sampling Activity Log Version 2

RAIN EVENT GENERAL INFORMATION				
Project Name				
Dept. Contract No.				
Contractor				
Sampler's Name				
Signature				
Date of Sampling				
Season (Check Applicable)	❒ Rainy		❒ Non-Rainy	
Storm Data	Storm Start Date & Time:		Storm Duration (hrs):	
	Time elapsed since last storm (Circle Applicable Units)	Min. Hr. Days	Approximate Rainfall Amount (mm)	

For rainfall information: http://cdec.water.ca.gov/weather.html or http://www.wrh.noaa.gov/wrhq/nwspage.html

SAMPLE LOG		
Sample Identification	**Sample Location**	**Sample Collection Date and Time**

Specific sample locations descriptions may include: 30m upstream from discharge at eastern boundary, runoff from northern waste storage area, downgradient of inlet 57 at kilometer post 36, etc.

FIELD ANALYSIS		
	Yes No	
Sample Identification	**Test**	**Result**

- Never touch the inside surface of a sample bottle or lid, even with gloved hands
- Never allow the inner surface of a sample bottle or lid to be contacted by any material other than the sample water
- Never allow any object or material to fall into or contact the collected sample water

- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles
- Do not eat or drink during sample collection
- Do not breathe, sneeze or cough in the direction of an open sample bottle
- Not leave the cooler lid open for an extended period of time once samples are placed inside

Grab Sample Collection. Manual grab samples will be collected by direct submersion of each individual sample bottle into the flow stream. It is also acceptable for intermediate containers to be used to collect samples. This intermediate sample is then poured immediately into the appropriate grab sample bottle(s).

Intermediate containers will collect one large sample to be distributed to several smaller sample bottles to help reduce the sampling time. When flows are too shallow to completely submerge a bottle, intermediate containers will be used to collect multiple samples to fill a single sample bottle. Intermediate containers are helpful when a sampling pole is employed because a single container can be attached to the pole and then used to collect multiple samples.

When transferring the sample from the intermediate container to the bottle, keep the sediment in suspension by stirring or swirling the container. Otherwise a portion of the sediment may settle out in the intermediate container and not be included in the sample that will be analyzed.

Samples bottles shall be filled to the top. If possible, grab samples shall be collected by completely submerging the bottle or container below the surface of the water to avoid collecting any material floating on the surface. When submerging the bottle, avoid hitting the bottom of the water body. For flow depths less than the diameter of the bottle, filling the bottle will not be possible unless an intermediate container is used.

Each bottle shall be rinsed out at least once with a small amount of the source water before taking the actual sample. This same procedure shall be followed when using an intermediate container to fill a bottle. Both the container and bottle shall be rinsed.

The bottle shall be opened at the last possible moment and the lid screwed back on immediately after the sample is collected. The lid shall be handled carefully during this time to avoid contaminating the inner lining. Hold the lid around the rim and face it down. If possible open and close the bottle under water when collecting a sample.

Upstream/Downstream Sampling Procedures. Samples collected at Stations CCUP1 and CCDN2 will use one of the following methods:

- Placing a sample bottle directly into the stream flow in or near the main current upstream of sampling crewmembers, and allowing the sample bottle to fill completely

- Placing a clean intermediate collection device in or near the main current to collect the sample, and then transferring the collected water to appropriate sample bottles, allowing the sample bottles to fill completely.

Samples will not be collected directly from ponded, sluggish, or stagnant water. Samples shall be collected at CCDN2 first, followed by CCUP1.

Standing on the bank and using a sampling pole to collect a sample is the preferred method. Wading into a water body to collect a sample should be avoided. Wading will disturb the bottom sediment and increase the suspended sediment levels in the water column where the samples will be collected. Wading into a river or creek is also dangerous during wet-weather events because flow rates are often higher. Wading should only be performed if the flow depth is less than 25 cm or one foot. Approach the sampling point from the downstream.

A series of five samples shall be collected at both stations during the first two hours of discharge. The interval between samples can vary. Since each sampling station will only be visited once during the two-hour period, all five samples will need to be collected over a short period, say 10 to 15 minutes.

Exact sampling locations at CCUP1 and CCDN2 may vary with each event. Sampling crews should be prepared to modify sampling locations or points in order to maximize the representativeness of the samples. Detailed field notes and or photographs shall be used to document the conditions and reasons for selecting a specific location to collect a sample.

Run-on Sampling Procedures. Samples at Stations CCRO1-CCRO7 will be collected. The collection procedures are a little different because run-on will arrive on site in a small drainage channel. To collect samples, the run-on flows will need to be at least 1 centimeter or 0.5 inches. Run-on that enters the site as sheet flow and not in a defined drainage ditch may not reach this depth. If not, one of the following two procedures can be employed:

- Several sand bags can be used to constrict the flows. Be careful the flow is not concentrated to the point the channel starts to erode and increases the amount of sediment in the flow.

- Place several rows of sand bags in a half circle directly in the path of the run-on to pond water and wait for enough water to spill over. Then place a cleaned or decontaminated flexible hose along the top and cover with another sandbag so that ponded water will only pour through the flexible hose and into sample bottles. Do not reuse the same sandbags in future sampling events as they may cross-contaminate future samples.

Filling a sample bottle is difficult when the bottles cannot be completely submerged. An intermediate container shall be used. For example, one sample bottle can be designated as the intermediate container and used to collect multiple grab samples to fill the remaining sample bottles. **Keep the sediment in suspension during each transfer.**

Sampling stations shall be approach from the downstream with samples collected facing upstream. Hitting the bottom with the bottle probably cannot be avoided, so lower the bottle slowly into the water to minimize the disturbance.

One (1) sample shall be collected at each of the seven stations, CCRO1-CCRO7, during the first two hours of discharge if flow is present.

Information regarding the final sampling locations selected for the event and the actual sample collection shall all be documented in the Sampling Activity Logs. Photographs are helpful to show the discharge(s), instream conditions, run-on flows, and sample collection methods.

<u>**Sample Handling Procedures**</u>

Sample Preservation. All samples are kept on ice or refrigerated to 4 degrees Celsius from the time of sample collection until delivery to the analytical laboratory. The grab samples are placed in an ice chest with ice immediately following collection. In addition to keeping the samples cool it is also important to minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample, resulting in unreliable analytical results. Therefore, all samples are covered or placed in an ice chest with a closed lid immediately following collection. No other preservatives are required.

Sample Delivery/Chain of Custody. All samples must be kept on ice, or refrigerated, from the time of onset of sample collection to the time of receipt by laboratory personnel. If samples are being shipped to the laboratory, place sample bottles inside coolers with ice, ensure that the sample bottles are well packaged, and secure cooler lids with packaging tape. It is imperative that all samples be delivered to the analytical laboratory and analysis begun within the maximum holding times specified by laboratory analytical (refer to Table 600-1). The holding time for TSS is 7 days. The holding time for SS is 48 hours. To minimize the risk of exceeding the holding times for SS, samples must be transferred to the analytical laboratory as soon as possible after sampling or within 24 hours. The sampling crew must in such cases coordinate activities with ABC Laboratories (refer to Figure 600-2) to ensure that holding times can be met.

Chain-of-custody (COC) forms are to be filled out by the sampling crew for all samples submitted to ABC Laboratories. Only the sample collectors will sign the COC form over to the lab. COC procedures will be strictly adhered to for QA/QC purposes. Sample date, sample location, and analysis requested are noted on each COC, including specification of lab quality control requirements (e.g., laboratory duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) samples).

Any special instructions for the laboratory shall also be noted. A note to remind the lab that composites samples need to be developed from the five samples collected at both the upstream and downstream stations. The lab shall develop the composite by taking equal volumes from each sample.

Copies of COC forms are kept with field notes in a field logbook. A sample COC is shown in Figure 600-5.

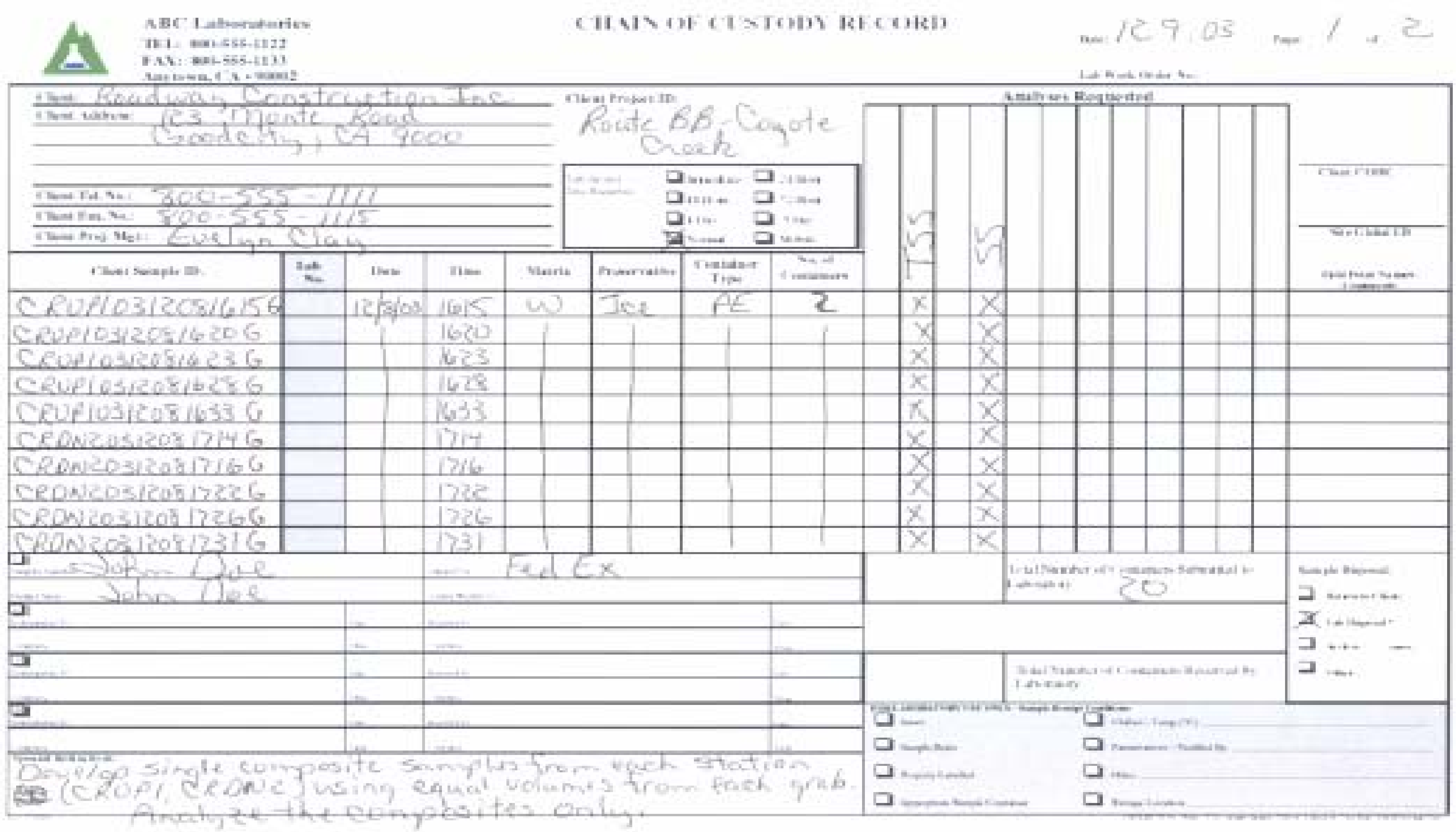
Sample Documentation Procedures. All original data documented on Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

Sampling and field analysis activities will be documented on the following standard forms:

- Sampling Activity Field Form: Template shown in Figures 600-3 and 600-4. Information on the form includes sampling date, separate times for sample collection of upstream, downstream, run-on, and QA/QC samples recorded to the nearest minute, unique sample identification number and location, names of sampling crewmembers, weather conditions (including precipitation amount), other pertinent data.

- Chain of Custody (COC) forms: All samples to be analyzed by a laboratory will be accompanied by a COC form provided by the laboratory.

Figure 600-5. Example of a Completed COC Form



ABC Laboratories

CHAIN OF CUSTODY RECORD

Date: 12.9.03 Page: 1 of 2

Client: Roadway Construction Inc.
Client Address: 123 Monte Road, Goodcity, CA 9000
Client Project ID: Route BB, Coyote Creek
Client Tel. No.: 800-555-1111
Client Fax. No.: 800-555-1115
Client Proj. Mgr.: Evelyn Clay

Analyses Requested: TSS, SS

Client Sample ID	Lab No.	Date	Time	Matrix	Preservative	Container Type	No. of Containers	TSS	SS
CRUP1031208161SG		12/8/03	1615	W	Ice	PE	2	X	X
CRUP1031208162OG			1620					X	X
CRUP1031208I623G			1623					X	X
CRUP1051208I628G			1628					X	X
CRUP1031208I633G			1633					X	X
CRDN2051208I714G			1714					X	X
CRDN2031208I716G			1716					X	X
CRDN2051208I722G			1722					X	X
CRDN2031208I726G			1726					X	X
CRDN2031208I731G			1731					X	X

John Doe
John Doe
Fed Ex

Total Number of Containers Submitted to Laboratory: 20

Sample Disposal: X Lab Disposal

Special Instructions: Develop single composite samples from each station (CRUP1, CRDN2) using equal volumes from each grab. Analyze the composites only.

- Storm Water Quality Construction Inspection Checklists: When applicable, the Contractor's storm water inspector will document on the checklist that samples for sedimentation/siltation and/or turbidity were taken during a rain event.

600.4.5 Sample Analysis

Samples will be analyzed for the constituents indicated in Table 600-1, "Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation".

600.4.6 Quality Assurance/Quality Control

Field duplicate samples shall be collected for every ten samples collected. The duplicate sample will be collected, handled, and analyzed using the same protocols as primary samples, and will be collected where contaminants are likely, and not on the upstream sample. Duplicate samples will not influence any evaluations or conclusions; however, they will be used as a check on laboratory quality assurance. Field duplicate samples shall be submitted to the laboratory "blind" (i.e. not identified as a QC sample, but labeled with a different station identification than the regular sample).

For grab samples, duplicate samples are collected by simultaneously filling two grab sample bottles at the same location. If intermediate containers are used, first pour an incremental amount into one sample bottle and then pour a similar amount into the second. Continue going back and forth until both bottles are full.

600.4.7 Data Management and Reporting

A copy of all water quality analytical results and QA/QC data will be submitted to the Resident Engineer within 30 days of sampling (for laboratory analyses).

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. Electronic data shall be reported in a format consistent with the Department's *2003-2004 Water Quality Data-Reporting Protocols* (November 2003).

Lab reports and COCs will be reviewed for consistency between lab methods, sample identifications, dates, and times for both primary samples and QA/QC samples. All data will be screened and validated using procedures outlined in Section 2.3.6 of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*.

All data, including COC forms and Sampling Activity Logs, shall be kept with the SWPPP document. Electronic results will be e-mailed to John Smith of RCI at John.Smith@dot.ca.gov after final sample results are received after each sampling event for inclusion into a statewide database.

Table 600-1
Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation

Constituent	Analytical Method	Test to be Used?	Sample Preservation	Minimum Sample Volume	Sample Bottle	Maximum Holding Time	Reporting Limit
Settleable Solids (SS)	EPA 160.5 Std Method 2540(f)	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)	1000 mL	Polyethylene plastic or glass	48 hours	0.1 mL/L/hr
Total Suspended Solids (TSS)	EPA 160.2 Std Method 2540(d)	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)	100 mL	Polyethylene plastic or glass	7 days	1 mg/L

Source: Adapted from Table 600-1 of the *SSWPPP/WPCP Preparation Manual* (March 2003)
Notes:
°C – Degrees Celsius
°F – Degrees Fahrenheit
EPA – U.S. Environmental Protection Agency
mL/L/hr – Milliliters per liter per hour
mg/L – Milligrams per liter
Std Method – Per the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, American Water Works Association

600.4.8 Data Evaluation

An evaluation of the water quality sample analytical results, including figures with sample locations, will be submitted to the Resident Engineer with the water quality analytical results and the QA/QC data for every event that samples are collected.

To identify water quality impacts within Coyote Creek, the percent difference between the upstream data and downstream data are calculated for TSS and SS. The percent difference is calculated using the following formula:

(Upstream result – Downstream result) / Upstream result * 100

If any of the results are reported as non-detects (ND), a value of one-half the reporting limit (RL) shall be used.

A percent difference between the upstream and downstream concentrations greater than 25 percent indicates a probable net increase of sediment or silt to Coyote Creek. Any negative value indicates the downstream concentration was lower than the upstream concentration, which indicates an improvement in water quality and no impact.

To identify water quality impacts from run-on from the seven stations (CCRO1-CCRO7), the results of the run-on samples shall be compared to the results from both the upstream and down stations. If the levels of TSS and SS from the run-on samples are higher than the upstream levels, this indicates the run-on could impact the instream levels and shall be investigated further. If the levels in the run-on are higher than the downstream levels, the run-on may be the source or one of the sources.

Should the downstream sample concentrations exceed the upstream sample concentrations and the primary source is from the Route BB construction site, the WPCM or other personnel will evaluate the BMPs, site conditions, surrounding influences (including run-on sample analysis), and other site factors to determine the probable cause for the increase. As determined by the data and project evaluation, appropriate BMPs will be repaired or modified to mitigate increases in sediment concentrations in the water body. Any revisions to the BMPs will be recorded as an amendment to the SWPPP. Sections 2.4.2-4 of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)* review procedures for assessing the need for corrective measures, implementing corrective measures, and reporting non-compliance

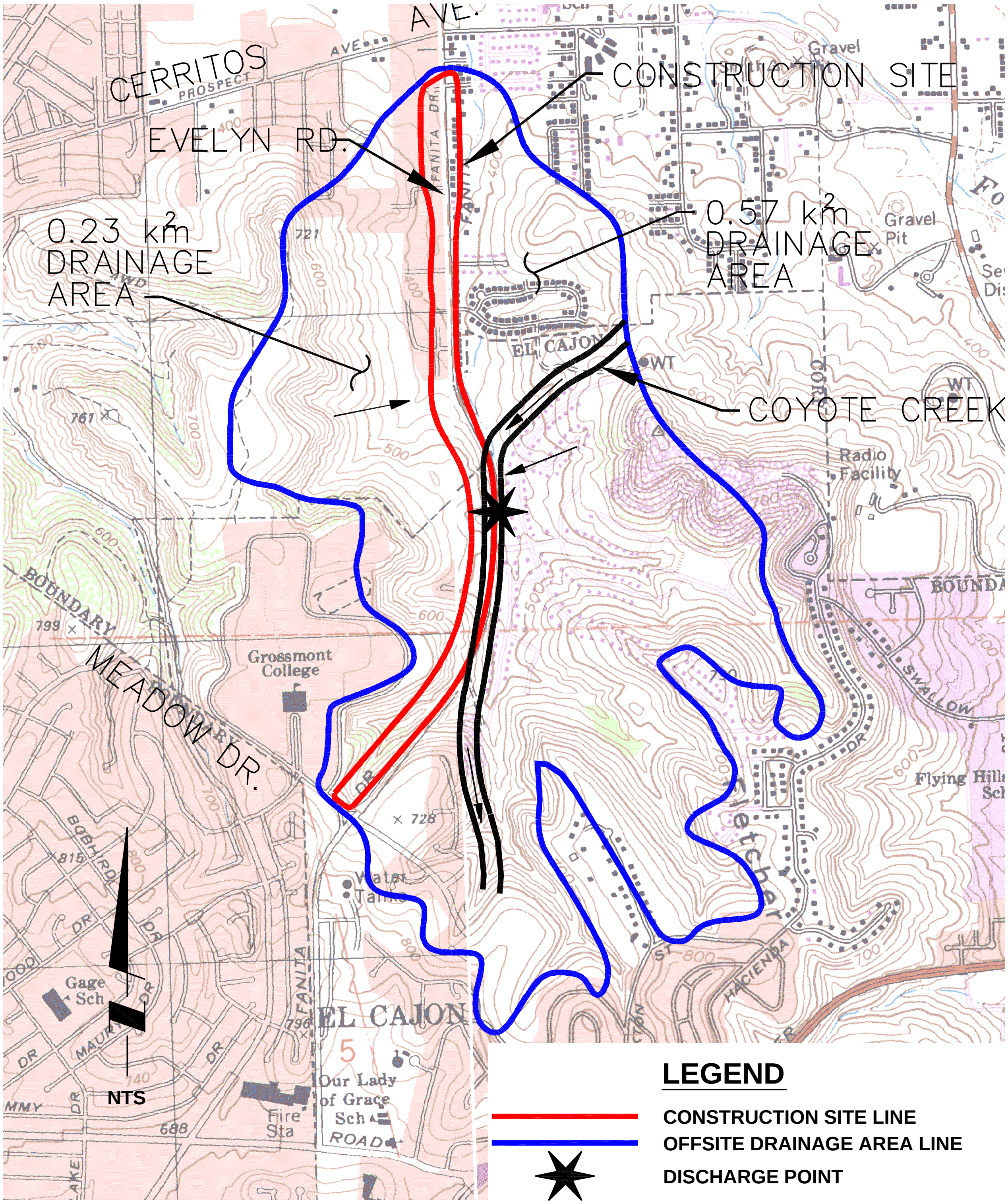
600.4.9 Change of Conditions

Whenever SWPPP monitoring, pursuant to Section B of the General Permit, indicates a change in site conditions that might affect the appropriateness of sampling locations, testing protocols will be revised accordingly. All such revisions will be recorded as amendments to the SWPPP.

Attachment B – Water Pollution Control Drawings

SEDIMENT/SITE MONITORING PLAN

VICINITY MAP
FOR
ROUTE BB
COYOTE CREEK, CALIFORNIA



LEGEND

CONSTRUCTION SITE LINE

OFFSITE DRAINAGE AREA LINE

DISCHARGE POINT

FLOW ARROW

E:\Caltrans\Catrans Model SWPPP\BB DWGs\ VicinityMap-BB.dwg 05/01/03 10:35

4.2 Non-Visible Pollutants

This model is based on Section 600.5, Sampling and Analysis Plan for Non-Visible Pollutants, from the *SWPPP/WPCP Preparation Manual* (March 2003). It has used the model SWPPP for Route AA. The model with its associated WPCD maps is attached to this section.

This model Storm Water Pollution Prevention Plan (SWPPP) is for a hypothetical $10 million construction project on Route AA to construct one mile of High Occupancy Vehicle (HOV) lane in the northbound and southbound directions in the city of Anytown, California. The existing aerially deposited lead (ADL) contaminated median soil will be removed and replaced with Asphalt Concrete pavement. The project also includes the removal and construction of a bridge at Meats Avenue and the reconstruction of a bridge at Taft Avenue to include HOV lanes, along with various retaining walls and soundwalls within the project limits. The project begins 0.2 miles south of Taft Avenue and continues north along Route AA. The project terminates 0.3 miles to the north of Meats Avenue.

The project discharges to the Carbon Creek Channel at Meats Avenue and involves an Environmentally Sensitive Area (ESA). The project area is 12 hectares (30 acres) in size with 8.5 hectares (21.5 acres) subject to soil-disturbing activities. The expected duration of the project will be approximately two years and two months.

The SWPPP for this project requires only one implementation stage as shown on the Water Pollution Control Drawings (WPCDs) in Attachment B of the model. The major Best Management Practice features include:

- Erosion control by scheduling, preserving the existing vegetation, and using mulching and/or soil stabilizers, earth dikes, drainage swales and lined ditches, plastic sheeting and energy dissipaters.
- Sediment control using silt fencing, sandbags, storm drain inlet protection, sediment traps, check dams, street sweeping and vacuuming.
- Sediment tracking control using stabilized construction entrances and sweeping and vacuuming.
- Non-storm water pollutant control practices using contaminated soil and concrete waste management techniques and proper vehicle and equipment cleaning, fueling and maintenance practices.

Section 600.5 Sampling and Analysis Plan for Non-Visible Pollutants

This Sampling and Analysis Plan (SAP) for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in storm water discharges from the project site and offsite activities directly related to the project in accordance with the requirements of Section B of the General Permit, including modifications, and applicable requirements of the Department's *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*, and the applicable sections of the Department's *Guidance Manual: Stormwater Monitoring Protocols (Second Edition, July 2000).*

600.5.1 Scope of Monitoring Activities

The following construction materials, wastes or activities, as identified in Section 500.3.1, are potential sources of non-visible pollutants to storm water discharges from the project. Storage, use, and operational locations are shown on the WPCDs in Attachment B.

- Vehicle batteries
- Cleaning solvents
- Contaminated soil (from aerially deposited lead)
- Fertilizers, herbicides, and pesticides
- Treat wood stockpiles

The following existing site features, as identified in Section 500.3.3, are potential sources of non-visible pollutants to storm water discharges from the project. Locations of existing site features contaminated with non-visible pollutants are shown on the WPCDs in Attachment B.

- Aerially deposited lead (ADL) has been documented along the center divider for the entire project. Aerially deposited lead is typically found within the top 0.6 meters of material in unpaved areas along the center divider. Levels of lead found in this area range from less than 2.5 to 204 mg/kg total lead with an average concentration of 30.75 mg/kg total lead, as analyzed by EPA Test Method 6010 or EPA Test Method 7000 series. Locations of aerially deposited lead storage are shown on the WPCDs, Attachment B.

The following soil amendments have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil and will be used on the project site. Locations of soil amendment application are shown on the WPCDs in Attachment B.

- None

The project has the potential to receive storm water run-on with the potential to contribute non-visible pollutants to storm water discharges from the project. Locations of such run-on to the Department's right-of-way are shown on the WPCDs in Attachment B.

- None

600.5.2 Monitoring Strategy

Sampling Schedule

Samples for the applicable non-visible pollutant(s) and a sufficiently large uncontaminated background sample shall be collected during the first two hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during daylight hours (sunrise to sunset) and shall be collected regardless of the time of year, status of the construction site, or day of the week.

In conformance with the U.S. Environmental Protection Agency definition, a minimum of 72 hours of dry weather will be used to distinguish between separate rain events. If discharges begin at least two hours prior to sunrise and continue past daylight, no sampling will be performed.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during the required inspections conducted before or during rain events:

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents storm water contact and runoff from the storage area.

- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

- An operational activity, including but not limited to those in Section 600.5.1, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) applicable BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

- Storm water runoff from an area contaminated by historical usage of the site has been observed to combine with storm water runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

Sampling Locations

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use; accessibility for sampling, personal safety; and other factors in accordance with the applicable requirements in the Department's *Guidance Manual: Construction Site Storm Water Quality Sampling* and *Guidance Manual: Storm Water Monitoring Protocols*. Planned sampling locations are shown on the WPCDs and include the following:

- Three sampling locations (designated numbers S-1, S-2 and S-3) on the project site at the Contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and from areas where non-visible pollutant producing operations are planned. Sample location number S-1 is located in the Contractor's yard at the southeast corner of Taft Avenue and Route AA. Sample location number S-2 is located downstream of the Contractor's yard at the northeast corner of Meats and Route AA. Sample location number S-3 is located at the downstream end of the Contractor's yard along northbound AA between Taft and Meats.

- The four stations will be monitored for the following construction materials, wastes or activities, if the conditions listed under the "Sampling Schedule" section above occur:

    - Vehicle batteries: Stations S1, S2, S3, S4

    - Cleaning solvents: Stations S1, S2, S3, S4

    - Contaminated soil (from aerially deposited lead) : Stations S1, S2, S3, S4

    - Fertilizers, herbicides, and pesticides: Stations S1, S2, S3, S4

    - Treat wood stockpiles: Stations S1, S4

- No sampling locations are required for the collection of samples of runoff that drain areas where soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil will be applied.

- No sampling locations are required for the collection of samples of runoff that drain areas contaminated by historical usage of the site.

- No sampling locations are required for the collection of samples of run-on to the Department's right–of-way with the potential to combine with discharges being sampled for non-visible pollutants. These samples are intended to identify sources of potential non-visible pollutants that originate off the project site.

- A location (designated number S-4) has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. This location was selected such that the sample will not have come in contact with (1) operational or storage areas associated with the materials, wastes, and activities identified in Section 500.3.1; (2) potential non-visible pollutants due to historical use of the site as identified in Section 500.3.3; (3) areas in which soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied; or (4) disturbed soil areas. Sample location S-4 is located in the northern portion of Route AA at station 262+00 where water flows onto the site.

If an operational activity or storm water inspection conducted 24 hours prior to or during a rain event identifies the presence of a material storage, waste storage, or operations area with spills or the potential for the discharge of non-visible pollutants to surface waters or a storm sewer system that was an unplanned location and has not been identified on the WPCDs, sampling locations will be selected using the same rationale as that used to identify planned locations.

600.5.3 Monitoring Preparation

This section covers topics of training, and preparation and logistics. The information presented in this section was adapted from the Department's *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*, Section 3.3.

Training

All sampling crewmembers and alternates will receive training on the monitoring techniques and protocols specified in the SAP so water samples are collected in a manner that meets the goals of the plan, while protecting the health and safety of the sampling crewmembers. Field monitoring training will include the following basic elements:

- Review Sampling and Analysis Plan

- Review Health and Safety
- Training/Sampling Simulation (Dry Run)

Review SAP and Health & Safety. All the Contractor's sampling crewmembers and alternates will read the entire SAP developed for the construction site to obtain the background information required for an overall understanding of the project.

The Contractor's crewmembers will be made aware of potential hazards associated with sampling. These hazards can include slippery conditions, cold or hot temperatures, open water that may be fast moving and or deep, construction site traffic, and contaminated water. Crewmembers need to become familiar with the methods to be employed to cope with those hazards.

Safety practices for sample collection will be in accordance with the *Roadway Construction, Inc. Health and Safety Plan*, dated November 2003. Several general procedures that must be followed at all times include:

- All sampling crewmembers must wear hard hats, traffic vests, and steel-toed boots when working outside the vehicle.
- Traffic control must be set up before conducting any work in the Department's right-of-way where sampling crewmembers will be exposed to traffic. Standard traffic control measures include parking vehicles to shield crewmembers from traffic and using hazard lights.
- Clean nitrile gloves will be worn by all sampling crewmembers when working with sampler bottles (empty and filled) and during grab sampling.
- All electronic equipment shall be kept as dry as possible.
- Cell phones use shall be avoided or minimized while driving.

Sampling Simulation (Dry Run). A training session will be held for all of the Contractor's sampling crewmembers and alternates to review the sampling techniques and protocols specified in this SAP. The Contractor's training session will be organized in a chronological fashion, in order to follow the normal train of events from pre-monitoring preparations through post-monitoring activities. All standard operating procedures will be covered, along with the site-specific responsibilities of individual crewmembers.

The training will include a visit to the construction site where a sampling simulation, or "dry run," can be conducted under the supervision of the project manager or sampling crew leader. During the "dry run" sampling crewmembers travel to their assigned sampling locations and run through the procedures specified in the Sample Collection section of the SAP, including:

- Site access and parking at the site
- Traffic control measures (if any)
- Preparing the stations for monitoring
- Collecting water samples
- Completing sample labels, field log forms, and COCs
- Packing samples
- Delivering or shipping samples to the laboratory

Preparations and Logistics

Sample bottle ordering, bottle labels, field equipment maintenance, monitoring event selection criteria, weather tracking, and notification procedures are presented in this section.

Bottle Order. Prior to the first targeted storm and immediately after each monitored storm event, bottles for the next event must be ordered from the laboratory. Adequate grab sample bottles will be ordered for each of the monitoring stations, plus bottles for quality control samples. For each event the following bottles shall be available:

- 18 40-mL VOA glass for VOCs (solvents)
- 18 1-liter amber glass for SVOCs, pesticides, and herbicides
- 6 250-mL high density polyethylene for metals (lead and copper)
- 6 1-liter high density polyethylene for pH and nutrients

The bottles are to be cleaned by the laboratory according to the methods specified in Appendix D of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*.

Sample Labels. Grab sample bottles shall be pre-labeled to the extent possible before each monitoring event. Pre-labeling sample bottles simplify field activities, leaving only date, time, sample number, and sampling crewmembers names to be filled out in the field. Basic bottle labels are available pre-printed with space to pre-label by hand writing or typing. Custom bottle labels may be produced using blank labels, labeling software, and waterproof ink. The bottle label shall include the following information, with other items as appropriate:

Route AA – Non-Visible Pollutant Monitoring Program
Route AA Reconstruction

Date: ________________________________
Time: _______________________________
Station #: ____________________________
Collected by: _________________________
Sample ID: ___________________________(see below for sample code development)

Each sample bottle label shall include a sample identification code as shown below.

SSYYMMDDHHmmTT

Where:

SS	=	station number (S1, S2, S3, S4)
YY	=	last two digits of the year (01)
MM	=	month (01-12)
DD	=	day (01-31)
HH	=	hour sample collected (00-23)
mm	=	minute sample collected (00-59)
TT	=	Type or QA/QC Identifier (if applicable)

G	=	Grab
FD	=	field duplicate
EB	=	equipment blank
TB	=	trip blank

For a grab sample collected at Station S1 collected at 4:15 PM on December 8, 2003, the sample number will be:

S10312081615G

Sample labels will be placed on the bottle rather than the cap to identify the sample for laboratory analysis. Bottles shall be labeled in a dry environment prior to sampling crew mobilization. Attempting to apply labels to sample bottles after filling may cause problems, as labels usually do not adhere to wet bottles. Following labeling, clear scotch tape shall be applied over the label to prevent ink from smearing.

Field Equipment Maintenance. An adequate stock of supplies and equipment for monitoring sediment/silt will be available on the project site or provided by ABC Laboratories prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight.

Prior to the first targeted storm and immediately after each of the subsequent sampling events, sampling crewmembers will inventory the field equipment shown in Figure 600-1. Field equipment shall be kept in one location, which is used as a staging area to simplify sampling crew mobilization.

Figure 600-1. Field Equipment Checklist

☐	First aid kit	☐	Sampling and Analysis plan
☐	Log books/log sheets	☐	Chain of Custody forms
☐	“Rite-n-Rain” pens	☐	Markers – fine point
☐	Paper towels	☐	Coolers and ice
☐	Required grab sample bottles	☐	Spare bottle labels
☐	Grab pole	☐	Intermediate sample container
☐	Weather –resistant camera	☐	Powder-free nitrile gloves
☐	Rubber bands / Duct tape	☐	Zip-lock baggies
☐	Cellular phone	☐	Hardhats/orange safety vests
☐	Personal rain gear	☐	Life ring with rope
☐	pH field meter (calibrated)	☐	Sand bags

Weather Tracking. The Resident Engineer or Department inspector and the Water Pollution Control Manager (WPCM) or other assigned Contractor staff member will track weather conditions and potential storms. Weather will be tracked using a number of sources including local newspapers and TV news programs, the Weather Channel, the National Weather Service (NWS) at www.nws.noaa.gov, and other Internet sites for radar imagery and hourly weather observations from a network of surface weather monitoring stations throughout California.

Communications. A communication plan has been developed to clearly define lines of communication and notification responsibilities. The plan is shown in Figure 600-2. It will be used for sampling station and preparation activities, crewmember notification of forecasted events, communications during sampling, and coordinating site and BMP evaluations following an event. Emergency telephone numbers are listed, including numbers of hospitals nearest the construction site.

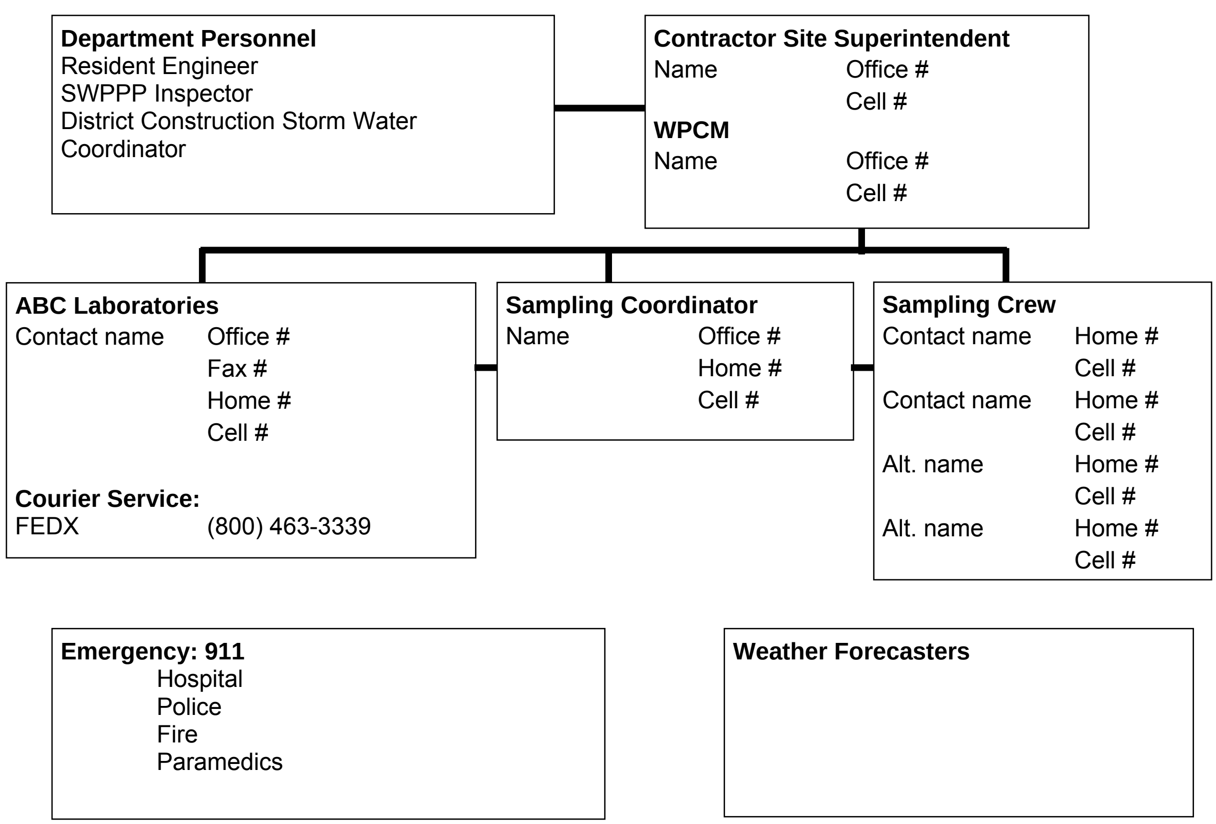
WPCM will begin to contact Sampling Coordinator and ABC Laboratories 48 hours prior to a predicted rain event to ensure that adequate number of sampling crewmembers, supplies and field equipment for monitoring sediment/silt are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.

When first alerted, sampling crewmembers shall consult their sampling plan and check field equipment and supplies to ensure they are ready to conduct any sampling. The pH meter shall be calibrated using standard buffer solutions. Before arriving at the site, the sampling crew will need to obtain ice (for sample preservation). Ice for grab samples shall be kept in ice chests where full grab sample bottles will be placed. Keeping ice in zip-lock bags facilitates clean easy ice handling. Refreezable ice packets are generally not recommended because they are susceptible to leakage. If a discharge is observed, the sampling crewmembers will be ready to perform the required tasks within the first two hours of the discharge.

Personal Safety. Before samples are collected, crewmembers must ensure the safety of such activities at each sampling location. Personal safety shall be considered when selecting monitoring stations. Adherence to the following recommendations will minimize risks to sampling crewmembers:

- Two-person sampling crews shall be available for all fieldwork to be conducted under adverse weather conditions, or whenever there are risks to personal safety.
- Crewmembers must be trained regarding appropriate on-site construction traffic control measures.

Figure 600-2. Communication Plan



600.5.4 Analytical Constituents

Identification of Non-Visible Pollutants

Table 600-1 lists the specific sources and types of potential non-visible pollutants on the project site, the applicable water quality indicator constituent(s) for each pollutant, and the sampling station selected to monitoring the source.

Table 600-1
Potential Non-Visible Pollutants and Water Quality Indicator Constituents

Pollutant Source	Pollutant	Water Quality Indicator Constituent	Station ID
Vehicle Batteries	Lead, Sulfate, or pH	Lead, pH	S1, S2, S3, S4
Contaminated Soil	Aerially Deposited Lead	Lead	S1, S2, S3, S4
Landscaping Product	Fertilizers-Inorganic	Nitrate, Phosphate	S1, S2, S3, S4
Landscaping Product	Herbicides-Roundup	Glyphosphate	S1, S2, S3, S4
Landscaping Product	Pesticides-OrtheneAcephate	Organophosphates	S1, S2, S3, S4
Cleaning Products	Solvents	Organic compounds	S1, S2, S3, S4
Treated wood	Cu Naphthenate	Copper	S1, S4

600.5.5 Sample Collection and Handling

Sample Collection Procedures

Samples of discharge will be collected at the designated sampling locations shown on the WPCDs for observed breaches, malfunctions, leakages, spills, operational areas, fertilizer application areas, and stockpiles that triggered the sampling event.

Grab samples will be collected and preserved in accordance with the methods identified in Table 600-2, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants" provided in Section 600.5.6. Only crewmembers trained in proper water quality sampling will collect samples. Figure 600-3 presents a field form to document all activities, samples, and observations.

Sampling Equipment and Bottles. It is important to use the appropriate sample bottles and equipment for each parameter to be measured (Refer to Table 600-1). Improper bottles and equipment can introduce contaminants and cause other errors, which can invalidate the data.

Immediately prior to the filling of grab sample bottles, the bottle labels shall be checked, and site- and event-specific information added using a waterproof pen. Attempting to label grab sample bottles after sample collection may be difficult because of wet labels.

Clean Sampling Techniques. All storm water quality sampling performed at Department construction sites shall employ "clean" sampling techniques to minimize potential sources of sample contamination. Care must be taken during all sampling operations to minimize exposure of the samples to human, atmospheric, and other potential sources of contamination. To reduce potential contamination, sampling crewmembers must adhere to the following rules while collecting storm water samples:

- Always used laboratory cleaned sample bottles and intermediate containers
- No smoking
- Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
- Always wear clean, powder-free nitrile gloves when handling bottles, containers and lids

Figure 600-3. Sampling Activity Log

RAIN EVENT GENERAL INFORMATION				
Project Name				
Dept. Contract No.				
Contractor				
Sampler's Name				
Signature				
Date of Sampling				
Season (Check Applicable)	❒ Rainy		❒ Non-Rainy	
Storm Data	Storm Start Date & Time:		Storm Duration (hrs):	
	Time elapsed since last storm (Circle Applicable Units)	Min. Hr. Days	Approximate Rainfall Amount (mm)	

For rainfall information: http://cdec.water.ca.gov/weather.html or http://www.wrh.noaa.gov/wrhq/nwspage.html

SAMPLE LOG		
Sample Identification	**Sample Location**	**Sample Collection Date and Time**

Specific sample locations descriptions may include: 30m upstream from discharge at eastern boundary, runoff from northern waste storage area, downgradient of inlet 57 at kilometer post 36, etc.

FIELD ANALYSIS		
	Yes No	
Sample Identification	**Test**	**Result**

- Never touch the inside surface of a sample bottle or lid, even with gloved hands
- Never allow the inner surface of a sample bottle or lid to be contacted by any material other than the sample water
- Never allow any object or material to fall into or contact the collected sample water
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles
- Do not eat or drink during sample collection
- Do not breathe, sneeze or cough in the direction of an open sample bottle
- Not leave the cooler lid open for an extended period of time once samples are placed inside

Grab Sample Collection. Samples will be collected by placing a separate lab-provided sample container directly into a stream of water downgradient and within close proximity to the potential non-visible pollutant discharge location. This separate lab-provided intermediate sample will be used to collect water, which will be transferred to sample bottles for laboratory analysis. The upgradient and uncontaminated background samples shall be collected first prior to collecting the downgradient to minimize cross-contamination. The sampling crewmembers will collect the water upgradient of where they are standing.

Intermediate containers will collect one large sample to be distributed to several smaller sample bottles to help reduce the sampling time. When flows are too shallow to completely submerge a container, intermediate containers can be used to collect multiple samples to fill a single sample bottle. Intermediate containers are helpful when a sampling pole is employed because a single container can be attached to the pole and then used to collect multiple samples.

When transferring the sample from the intermediate container to the bottle, keep the sediment in suspension by stirring or swirling the container. Otherwise a portion of the sediment may settle out in the intermediate container and not be included in the sample that will be analyzed.

Samples bottles shall be filled to the top. If possible, grab samples shall be collected by completely submerging the bottle or container below the surface of the water to avoid collecting any material floating on the surface. When submerging the bottle, avoid hitting the bottom of the water body. For flow depths less than the diameter of the bottle, filling the bottle will not be possible unless an intermediate container is used.

Each bottle shall be rinsed out at least once with a small amount of the source water before taking the actual sample. This same procedure shall be followed when using an intermediate container to fill a bottle. Both the container and bottle shall be rinsed.

The bottle shall be opened at the last possible moment and the lid screwed back on immediately after the sample is collected. The lid shall be handled carefully during this time to avoid contaminating the inner lining. Hold the lid around the rim and face it down. If possible open and close the bottle under water when collecting a sample.

The pH reading can be taken from a sample collected in the intermediate container. The reading shall be recorded on the standard field form.

VOC samples need to be collected using VOA bottles. For the VOA bottles, no air bubbles should be present in the sample. Each bottle shall be filled so the sample bulges above the rim. Filling the cap with additional sample can complete the filling. After screwing on the cap, turn the bottle over and check for bubbles. If bubbles are present add more sample by using the cap as the intermediate container.

Sampling locations may vary when sampling BMP failures. Sampling crews should be prepared to modify sampling locations or points in order to maximize the representativeness of the samples. Detailed field notes and or photographs shall be used to document the conditions and reasons for selecting a specific location to collect a sample.

To collect samples, the flows will need to be at least 1 centimeter or 0.5 inches. Flows in the defined drainage channels may reach this depth. If not, several sand bags can be used to either constrict the flows or create a temporary pond. Be careful the flow is not concentrated to the point the channel starts to erode and increases the amount of sediment in the flow.

The samples bottles for VOCs and metals (lead and copper) may contain a small amount of acid preservative. Each bottle will be clearly marked if the preservative is present. The preservatives are not necessary and may not always be included. If the preservative is present, do not overfill the bottles. Otherwise some of the preservative will be lost. Use an intermediate container or in the case of the VOCs, the bottle’s cap to complete the filling.

One (1) sample or measurement (pH) shall be collected at each station during the first two hours of discharge.

Sample Handling Procedures

Sample Preservation. All samples are kept on ice or refrigerated to 4 degrees Celsius from the time of sample collection until delivery to the analytical laboratory. The grab samples are placed in an ice chest with ice immediately following collection. In addition to keeping the samples cool it is also important to minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample, resulting in unreliable analytical results. Therefore, all samples are covered or placed in an ice chest with a closed lid immediately following collection. No other preservatives are required.

Sample Delivery/Chain of Custody. All samples must be kept on ice, or refrigerated, from the time of onset of sample collection to the time of receipt by laboratory personnel. If samples are being shipped to the laboratory, place sample bottles inside coolers with ice, ensure that the sample bottles are well packaged, and secure cooler lids with packaging tape. It is imperative that all samples be delivered to the analytical laboratory and analysis begun within the maximum holding times specified by laboratory analytical (refer to Table 600-2). Although all the analyses have relatively long holding times, the samples must be transferred to the analytical laboratory as soon as possible after sampling or within 24 hours. The sampling crew must in such cases coordinate activities with ABC Laboratories (refer to Figure 600-2) to ensure that holding times can be met.

Chain-of-custody (COC) forms are to be filled out by the sampling crew for all samples submitted to ABC Laboratories. Only the sample collectors will sign the COC form over to the lab. COC procedures will be strictly adhered to for QA/QC purposes. Sample date, sample location, and analysis requested are noted on each COC, including specification of lab quality control requirements (e.g., laboratory duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) samples).

Copies of COC forms are kept with field notes in a field logbook. A sample COC is shown in Figure 600-4.

Sample Documentation Procedures. All original data documented on Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

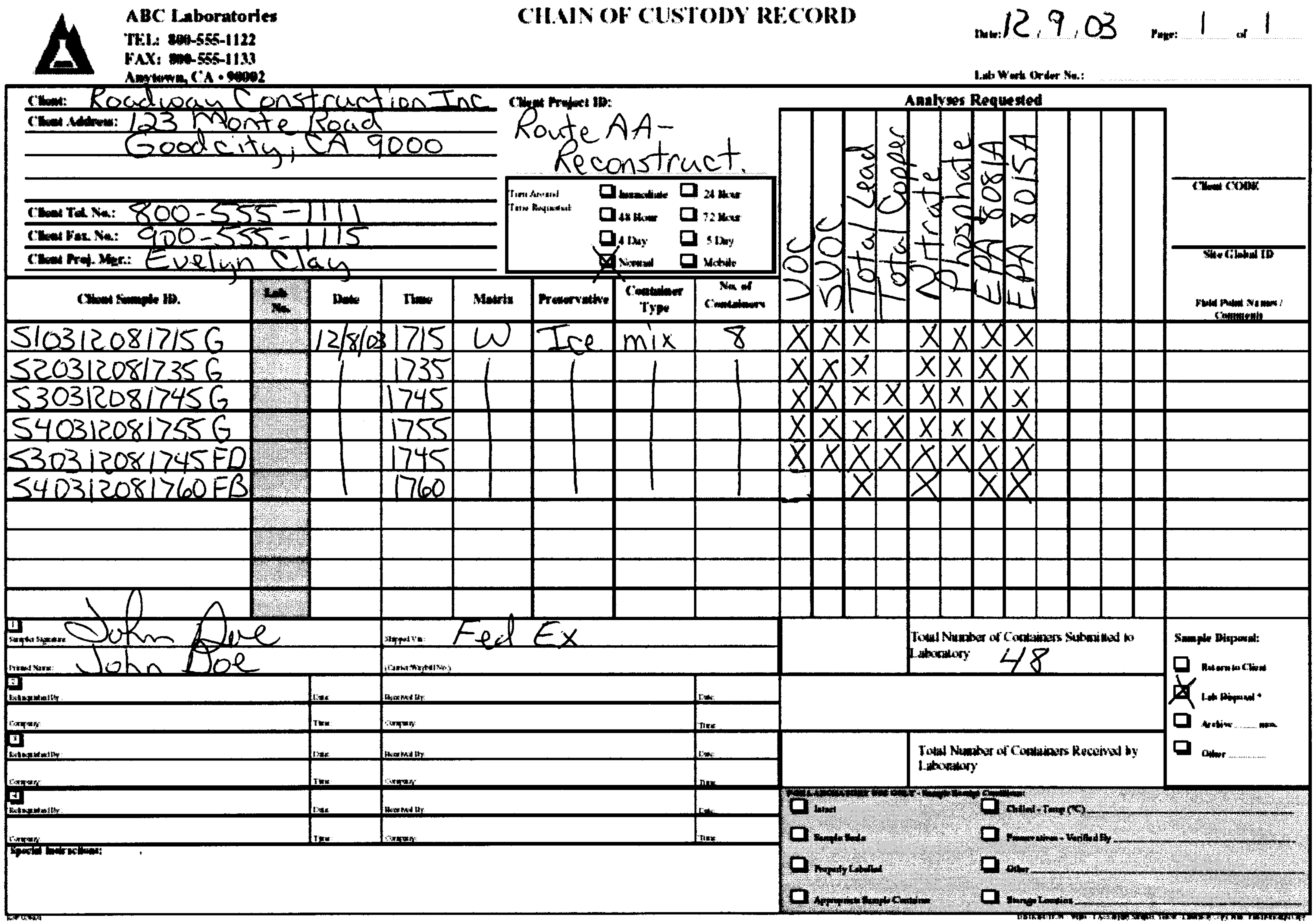
Sampling and field analysis activities will be documented on the following standard forms:

- <u>Sampling Activity Field Form</u>: Template shown in Figure 600-3. Information on the form includes sampling date, separate times for sample collection at the various sites, and QA/QC samples recorded to the nearest minute, unique sample identification number and location, names of sampling crewmembers, weather conditions (including precipitation amount), other pertinent data.

- Chain of Custody (COC) forms: Template shown in Figure 600-4. All samples to be analyzed by a laboratory will be accompanied by a COC form provided by the laboratory.

- Storm Water Quality Construction Inspection Checklists: When applicable, the Contractor's storm water inspector will document on the checklist that samples for sedimentation/siltation and/or turbidity were taken during a rain event.

Figure 600-4. Example of a Completed COC Form



ABC Laboratories
TEL: 800-555-1122
FAX: 800-555-1133
Anytown, CA • 90002

CHAIN OF CUSTODY RECORD

Date: 12, 9, 03 Page: 1 of 1

Lab Work Order No.:

Client: Roadway Construction Inc
Client Address: 123 Monte Road
Goodcity, CA 9000
Client Tel. No.: 800-555-1111
Client Fax. No.: 900-555-1115
Client Proj. Mgr.: Evelyn Clay

Client Project ID: Route AA-Reconstruct.

Turn Around Time Requested: ☐ Immediate ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 4 Day ☐ 5 Day ☒ Normal ☐ Mobile

Analyses Requested

Client Sample ID.	Lab No.	Date	Time	Matrix	Preservative	Container Type	No. of Containers	VOC	SVOC	Total Lead	Total Copper	Nitrate	Phosphate	EPA 8081A	EPA 8015A					Field Point Names / Comments
S1031208l715G		12/8/03	1715	W	Ice	mix	8	X	X	X		X	X	X	X					
S2031208l735G			1735					X	X	X		X	X	X	X					
S3031208l745G			1745					X	X	X	X	X	X	X	X					
S4031208l755G			1755					X	X	X	X	X	X	X	X					
S3031208l745FD			1745					X	X	X	X	X	X	X	X					
S4031208l760FB			1760							X		X		X	X					

Client CODE:
Site Global ID:

1 Sample Signature: John Doe
Printed Name: John Doe
Shipped Via: Fed Ex
(Carrier/Waybill No.)

2 Relinquished By: Date: Received By: Date:
Company: Time: Company: Time:

3 Relinquished By: Date: Received By: Date:
Company: Time: Company: Time:

4 Relinquished By: Date: Received By: Date:
Company: Time: Company: Time:

Special Instructions:

Total Number of Containers Submitted to Laboratory: 48

Total Number of Containers Received by Laboratory:

Sample Disposal:
☐ Return to Client
☒ Lab Disposal *
☐ Archive ____ mos.
☐ Other ____

☐ Intact ☐ Chilled - Temp (°C) ____
☐ Sample Seals ☐ Preservatives - Verified By ____
☐ Properly Labelled ☐ Other ____
☐ Appropriate Sample Containers ☐ Storage Location ____

600.5.6 Sample Analysis

Samples will be analyzed for the applicable constituents using the analytical methods identified in Table 600-2, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants" table in this section.

For samples collected for field analysis, collection, analysis and equipment calibration will be in accordance with the field instrument manufacturer's specifications.

The following field instrument(s) will be used to analyze the following constituents:

Field Instrument	Constituent
Waterproof pH tester (Oakton pHTestr 2)	pH

- The instrument will be maintained in accordance with manufacturer's instructions.
- The instrument will be calibrated before each sampling and analysis event.
- Maintenance and calibration records will be maintained with the SWPPP.

600.5.7 Quality Assurance/Quality Control

Given the suite of parameters, the QA/QC program will require the collection of equipment blanks (sampling bottles and intermediate containers), field blanks, trip blanks, field duplicates, and MS/MSD samples. Each type of QA/QC sample sis describe below. The collection schedule is laid out in Table 600-3.

<u>Equipment blanks</u> will be collected and analyzed for lead, nitrates, pesticides, and herbicides. Before using the sampling bottles and intermediate containers, a representative sample (2%) shall be tested to verify that the equipment is not a source of sample contamination. The sampling container blank is prepared by filling a clean container or bottle with blank water. The water is then analyzed for the selected parameters.

Collection of sample container blanks may not be required if certified pre-cleaned bottles are used. The manufacturer can provide certification forms that document the concentration to which the bottles are "contaminant-free"; these concentrations shall be equivalent to or less than the program reporting limits. If the certification level is above the program reporting limits, 2% of the bottles in a "lot" or "batch" shall be blanked at the program detection limits with a minimum frequency of one bottle per batch.

Table 600-2
Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

Constituent	Analytical Method	Minimum Sample Volume	Sample Bottle	Sample Preservation	Reporting Limit	Maximum Holding Time
VOCs-Solvents	EPA 601/602	3 x 40 mL	VOA-glass	Store at 4° C, HCl to pH<2	1 µg/L	14 days
SVOCs	EPA 625	1 x 1 L	Glass-amber	Store at 4° C	10 µg/L	7 days
Pesticides	EPA 8081A	1 x 1 L	Glass-amber	Store at 4° C	0.1µg/L	7 days
Herbicides	EPA 8151A	1 x 1 L	Glass-amber	Store at 4° C	Check Lab	7 days
Nitrate	EPA 300.0	100 mL	Polypropylene	Store at 4° C	0.1 mg/L	48 hours
Phosphate	EPA 300.0	100 mL	Polypropylene	Store at 4° C	0.1 mg/L	48 hours
pH	EPA 150.1	1 x 100 mL	Polypropylene	None	unitless	Immediate
Metals (Pb, Cu)	EPA 200.8	1 x 250 mL	Polypropylene	Store at 4° C, HNO_3 to pH<2	0.1 mg/L	6 months

Source: Adapted from Attachment S of the SWPPP/WPCP Preparation Manual (March 2003) and Department's Guidance Manual: Stormwater Monitoring Protocols (Caltrans July 2000)Department's Guidance Manual: Stormwater Monitoring Protocols (Caltrans July 2000)Adapted from Table 600-1 of the SSWPPP/WPCP Preparation Manual (Mar 2003)

Notes:

°C	–	Degrees Celsius	µg/L	–	Micrograms per Liter
mL	–	Milliliter	SVOC	–	Semi-Volatile Organic Compound
EPA	–	Environmental Protection Agency	HCl	–	Hydrochloric acid
HNO_3	–	Nitric acid	VOA	–	Volatile Organic Analysis
L	–	Liter	VOC	–	Volatile Organic Compound
mg/L	–	Milligrams per Liter			

Table 600-3
QC Schedule

Station	Pre-Season	Event #1	Event #2	Event #3	Event #4	Event #4
S-1	Equipment blank		Field Duplicate			MS/MSD
S-2		Trip Blank		MS/MSD		
S-3		Field Blank			Field Duplicate	
S-4		MS/MSD				

Field Blanks will be collected for lead, nitrates, pesticides, and herbicides. Field blanks are necessary to evaluate whether contamination is introduced during field sampling activities. The sampling crew, under normal sample collection conditions, prepares the field blanks at some time during the collection of normal samples. Grab sample field blanks shall be prepared by pouring a sample directly from the bottle of blank water, into the grab sample containers. Grab sample blanking should imitate environmental sampling as closely as possible by using clean intermediate containers, and other clean equipment in the same manner. The filled blank sample bottles shall be sealed and sent to the laboratory to be analyzed for the required constituents.

Field blanks will be collected at a frequency no less than once per sampling crew per sampling season. Additional blanks shall be collected when there is a change in sampling crewmembers, equipment, or procedures. It may also be desirable to prepare field blanks prior to any actual sampling events as an advance check of the overall sampling procedures.

Trip blanks will be collected for volatile organic compounds (VOCs). Trip blanks are used to determine whether sample contamination is introduced during sample transportation and delivery. Trip blanks are prepared at the analytical laboratory, by filling the sample bottle with blank water and securing the bottle lid. Trip blanks are transported to and from the sampling station with normal sample bottles. Trip blanks are analyzed like normal samples. Trip blanks will be collected at a frequency no less than once per sampling crew per sampling season.

Field duplicate samples shall be collected for every ten samples collected. The duplicate sample will be collected, handled, and analyzed using the same protocols as primary samples, and will be collected where contaminants are likely, and not on the upstream sample. Duplicate samples will not influence any evaluations or conclusions; however, they will be used as a check on laboratory quality assurance. Field duplicate samples should be submitted to the laboratory "blind" (i.e. not identified as a QC sample, but labeled with a different station identification than the regular sample).

For grab samples, duplicate samples are collected by simultaneously filling two grab sample bottles at the same location. If intermediate containers are used, first pour an incremental amount into one sample bottle and then pour a similar amount into the second. Continue going back and forth until both bottles are full.

MS and MSD analyses will be performed for lead, nutrients, and organics. MS/MSD analyses are used to assess the accuracy (MS) and precision (MSD) of the analytical methods in the sample matrix. When collecting samples to be specified for MS/MSD analysis, typically triple the normal sample volume is required. This will require filling a larger size sample bottle, or filling three normal size sample bottles, labeling one with the station name and the other two with the station name plus "MS/MSD". MS/MSD samples can be collected from one station during each event or one in every ten samples.

600.5.8 Data Management and Reporting

A copy of all water quality analytical results and QA/QC data will be submitted to the Resident Engineer within 5 days of sampling (for pH field analyses) and within 30 days (for laboratory analyses).

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. Electronic data shall be reported in a format consistent with Department's *2003-2004 Water Quality Data-Reporting Protocols* (November 2003).

Lab reports and COCs will be reviewed for consistency between lab methods, sample identifications, dates, and times for both primary samples and QA/QC samples. All data will be screened and validated using procedures outlined in Section 2.3.6 of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)*.

All data, including COC forms and Sampling Activity Logs, shall be kept with the SWPPP document. Electronic results will be e-mailed to John Smith of RCI at John.Smith@dot.ca.gov after final sample results are received after each sampling event for inclusion into a statewide database.

600.5.9 Data Evaluation

An evaluation of the water quality sample analytical results, including figures with sample locations, will be submitted to the Resident Engineer with the water quality analytical results and the QA/QC data.

To identify potential impacts of non-visible pollutant on receiving water bodies, the percent difference between the control data and test data are calculated for the constituents of concern. The percent difference is calculated using the following formula:

(Control result – Test result) / Control result * 100

If any of the results are reported as non-detects (ND), a value of one-half the reporting limit (RL) shall be used. For each station, all the individual field measurements shall be averaged together and the average value used in the equation.

A difference between the control and test concentrations greater than plus/minus twenty-five percent (±25%) indicates an impact from a non-visible pollutant.

Should the runoff from any of the test stations (S-1, S-2, S-3) demonstrate a change in the water quality relative to the background sample (S-4), the BMPs, site conditions, and surrounding influences will be assessed to determine the probable cause for the increase. As determined by the site and data evaluation, appropriate BMPs will be repaired or modified to mitigate discharges of non-visual pollutant concentrations. Any revisions to the BMPs will be recorded as an amendment to the SWPPP. Sections 3.4.2-4 of the *Guidance Manual: Construction Site Storm Water Quality Sampling (December 2003)* review procedures for assessing the need for corrective measures, implementing corrective measures, and reporting non-compliance.

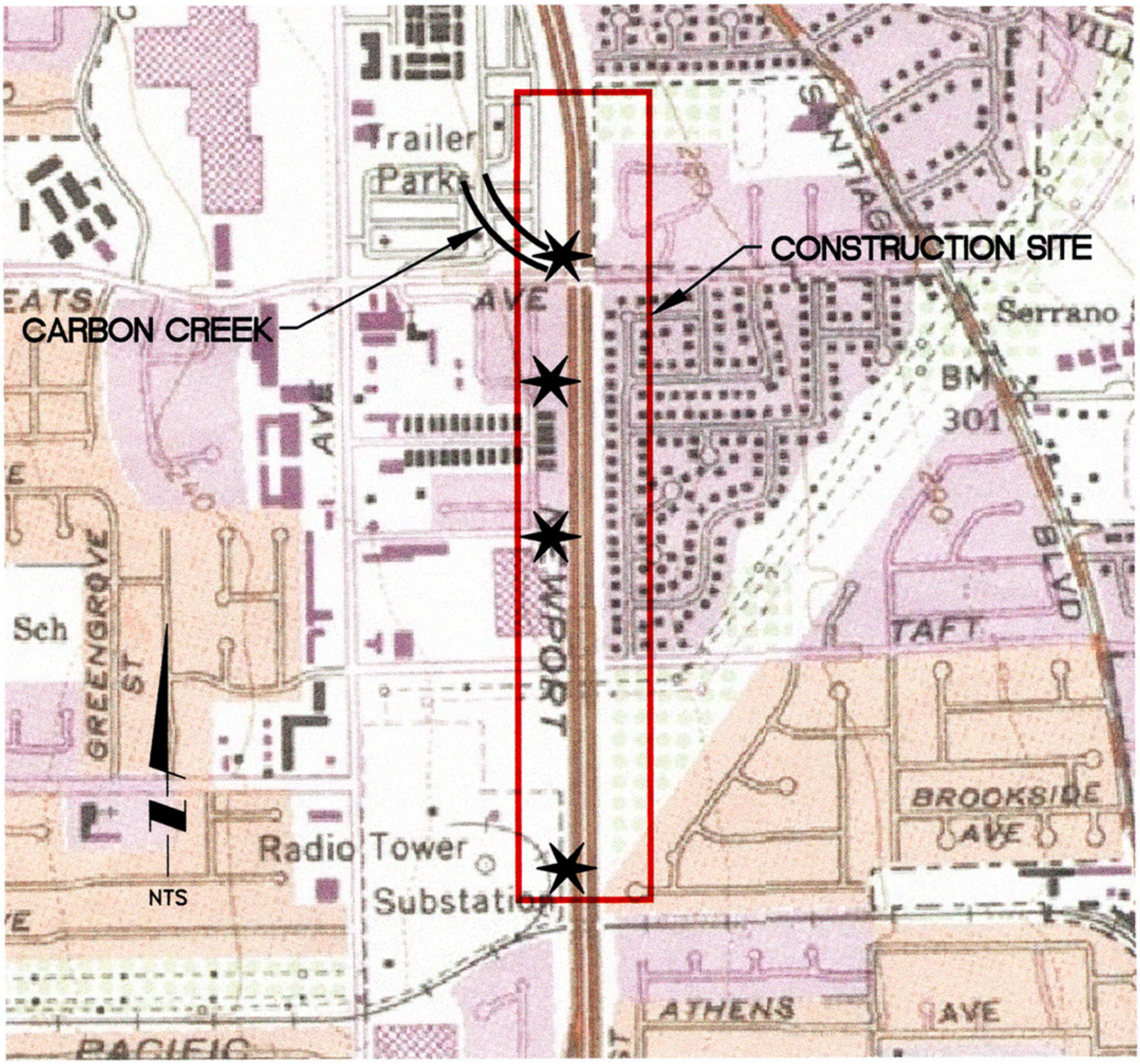
600.5.10 Change of Conditions

Whenever SWPPP monitoring, pursuant to Section B of the General Permit, indicates a change in site conditions that might affect the appropriateness of sampling locations or introduce additional non-visible pollutants of concern, testing protocols will be revised accordingly. All such revisions will be recorded as amendments to the SWPPP.

Attachment B – Water Pollution Control Drawings

STORM WATER POLLUTION PREVENTION PLAN

VICINITY MAP
FOR
ROUTE AA
BIGTREE COUNTY, CALIFORNIA



LEGEND

CONSTRUCTION SITE LINE

DISCHARGE POINT

E:\Caltrans\Caltrans Model SWPPP\AA DWGs\ VicinityMap-AA.dwg 05/01/03 10:47

Section 5
Further Assistance

California Department of Transportation

Environmental Program

http://www.dot.ca.gov/hq/env/index.htm

Storm Water Management Program

http://www.dot.ca.gov/hq/env/stormwater/

Department NPDES Permit

http://www.swrcb.ca.gov/stormwtr/docs/factsheet.doc

Guidance Manual: Stormwater Monitoring Protocols

http://www.dot.ca.gov/hq/env/stormwater/special/index.htm

Storm Water Quality Handbooks

http://www.dot.ca.gov/hq/construc/

Regional Water Quality Control Boards

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
NORTH COAST REGION	5550 Skylane Blvd., Suite A Santa Rosa, CA 95403	John Short shorj@rb1.swrcb.ca.gov	(707) 576-2065 FAX: (707) 523-0135
SAN FRANCISCO BAY REGION	1515 Clay St., Suite 1400 Oakland, CA 94612	Hossain Kazemi mhk@rb2.swrcb.ca.gov	(510) 622-2369 FAX: (510) 622-2460
CENTRAL COAST REGION	81 Higuera St., Suite 200 San Luis Obispo, CA 93401-5427	Jennifer Bitting jbitting@rb3.swrcb.ca.gov	(805) 549-3334 FAX: (805) 543-0397
LOS ANGELES REGION	320 W. 4th St., Suite 200 Los Angeles, CA 90013	Yi Lu (Inland Los Angeles) ylu@rb4.swrcb.ca.gov	(213) 576-6728 FAX: (213) 576-6686
		Ejigu Soloman (Ventura County) esoloman@rb4.swrcb.ca.gov	213) 576-6727 FAX: (213) 576-6686
		Xavier Swamikannu (Coastal) xswami@rb4.swrcb.ca.gov	(213) 576-6654 FAX (213) 576-6686
CENTRAL VALLEY REGION **Sacramento Office**	3443 Routier Rd., Suite A Sacramento, CA 95827-3098	Sue McConnell mcconns@rb5s.swrcb.ca.gov	(916) 255-3098 FAX: (916) 255-3015
CENTRAL VALLEY REGION **Fresno Branch Office**	3614 East Ashlan Ave. Fresno, CA 93726	Jarma Bennett bennettj@rb5f.swrcb.ca.gov	(559) 445-6046 FAX: (559) 445-5910

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
CENTRAL VALLEY REGION **Redding Branch Office**	415 Knollcrest Dr. Redding, CA 96002	Carole Crowe crowec@rb5r.swrcb.ca.gov	(530) 224-4849 FAX: (530) 224-4857
LAHONTAN REGION **South Lake Tahoe Office**	2501 Lake Tahoe Blvd. South Lake Tahoe, CA 96150	Mary Fiore-Wagner fiorm@rb6s.swrcb.ca.gov	(530) 542-5245 FAX: (530) 544-2271
LAHONTAN REGION **Victorville Office**	15428 Civic Dr., Suite 100 Victorville, CA 92392	Eugene Rondash erondash@rb6v.swrcb.ca.gov	(760) 241-2434 FAX: (760) 241-7308
COLORADO RIVER BASIN REGION	73-720 Fred Waring Dr., Suite 100 Palm Desert, CA 92260	Abdi Haile haila@rb7.swrcb.ca.gov	(760) 776-8939 FAX: (760) 341-6820
		Rosalyn Fleming flemr@rb7.swrcb.ca.gov	(760) 776-8939 FAX: (760) 341-6820
SANTA ANA REGION	3737 Main St., Suite 500 Riverside, CA 92501-3339	Michael Roth (Riverside County) mroth@rb8.swrcb.ca.gov	(909) 320-2027 FAX: (909) 781-6288
		Aaron Buck (Orange County) abuck@rb8.swrcb.ca.gov	(909) 782-4469 FAX: (909) 781-6288
		Muhammad Bashir (San Bernardino County) mbashir@rb8.swrcb.ca.gov	(909) 320-6396 FAX: (909) 781-6288
SAN DIEGO REGION	9771 Clairemont Mesa Blvd., Suite A San Diego, CA 92124	Jane Ledford ledfj@rb9.swrcb.ca.gov	(858) 467-3272 FAX: (858) 571-6972

State Water Resources Control Board
Division of Water Quality
Storm Water Permit Section
P.O. Box 1977
Sacramento, CA 95812-1977
Construction Inquiry Line: (916) 341-5537
Web Site: http://www.swrcb.ca.gov/
E-mail: stormwater@swrcb.ca.gov

General Construction Permit

http://www.swrcb.ca.gov/stormwtr/construction.html

303(d) Listing of Impaired Water Bodies (including a database linked to GIS maps)

http://www.swrcb.ca.gov/tmdl/303d_lists.html

How to Obtain a List of State Certified Laboratories

http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm

Other Useful Web Sites

California Stormwater Quality Task Force

http://www.stormwatertaskforce.org/

Section 6
Glossary

Al	Aluminum
As	Arsenic
ASTM	American Society for Testing and Materials
Ba	Barium
Be	Beryllium
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
Ca	Calcium
$CaCO_3$	Calcium Carbonate
Caltrans	California Department of Transportation
Cd	Cadmium
COC	Chain of Custody
COD	Chemical Oxygen Demand
CLP	Contract Laboratory Program
Co	Cobalt
Cr	Chromium
Cu	Copper
°C	Degrees Celsius
°F	Degrees Fahrenheit
Department	California Department of Transportation
DHS	Department of Health Services
DOC	Dissolved Organic Carbon
EB	Equipment blank
EC	Electrical conductivity, same as specific conductance
EDD	Electronic data delivery
EPA	U.S. Environmental Protection Agency
Fe	Iron
FB	Field Blank

FD	Field Duplicate
G	A single sample collected to represent instantaneous conditions.
HCl	Hydrogen Chloride
HDPE, PE	High-density polyethylene
Hg	Mercury
HNO_3	Nitric Acid
HRD	Hardness
H_2SO4	Hydrogen Sulfide
L	Liter
LCS	Laboratory control sample. A clean matrix spiked with known concentrations of target analytes that is used to evaluate laboratory accuracy, independent of matrix effects.
m	meter
MB	Method blank. Reagent water (Type II) that is taken through the entire analytical procedure and used to evaluate contamination from laboratory procedures or conditions.
µg/L	Microgram per Liter
µmhos/cm	Micromhos per centimeter
Mg	Magnesium
mg/L	Milligram per Liter
mL	Milliliter
mL/L/hr	Milliliters per liter per hour
Mn	Manganese
Mo	Molybdenum
MPN	Most probable number
MS/MSD	Matrix spike/matrix spike duplicate. An environmental sample spiked with known concentrations of target analytes that is used to evaluate the accuracy and precision of the laboratory extraction and analysis procedures.
NA	Not available

Na	Sodium
ND	Non detect
Ni	Nickel
NO3, NO_3-N	Nitrate
NO2	Nitrite
NTU	Nephelometric Turbidity Unit
NWS	National Weather Service
P	Phosphorous
Pb	Lead
PCB	Polychlorinated Biphenyl
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
RE	Resident Engineer
RL	Reporting limits. Minimum value that can be reported with confidence for any given parameter as established by a specific laboratory.
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SC	Specific Conductance
Se	Selenium
SS	Settable solids
SSC	Suspended Sediment Concentration
Std Method, SM	Per the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, American Water Works Association
SSP	Standard Special Provisions
SVOC	Semi-Volatile Organic Compound
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TB	Trip Blank
TDS	Total Dissolved Solids

Th	Thorium
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TSS	Total Suspended Solids
Va	Vanadium
VOC	Volatile organic compound
WPCD	Water Pollution Control Drawing
WPCM	Water Pollution Control Manager
Zn	Zinc

Section 7
References

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Caltrans, 2003. Caltrans Storm Water Monitoring & Research Program 2003-2004 Water Quality Data-Reporting Protocols (CTSW-RT-03-095.51.42). Available from the Department's Storm Water Monitoring Program. November 2003.

Caltrans, 2003. Caltrans Storm Water Quality Handbooks SWPPP/WPCP Preparation Manual. March 1, 2003.

California Stormwater Quality Task Force (SWQTF), 2001. Construction Storm Water Sampling and Analysis Guidance Document. October 2001.

USEPA, 1995. Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring. USEPA Office of Water. EPA 821-B-95-002. April 1995.

USGS, 2000. Collection and Use of Total Suspended Solids Data. Office of Water Quality Technical Memorandum No. 2001.03. United States Geological Survey. November 27, 2000.

Appendix A

State Water Resource Control Board

303(d) Listed Water Bodies

for Sedimentation/Siltation or Turbidity

1. **Table of 303(d) water bodies**
2. **GSI maps of impaired segments**
3. **Instructions for identifying geographical coordinates on**

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS FOR SEDIMENTATION/SILTATION AND TURBIDITY (Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
1	North Coast	Albion River, Mendocino Coast HU, Albion River HA	Sedimentation/Siltation	Rivers/Streams	77	Miles	
1	North Coast	Big River, Mendocino Coast HU, Big River HA	Sedimentation/Siltation	Rivers/Streams	225	Miles	
1	North Coast	Eel River Delta, Eel River HU, Lower Eel River HA	Sedimentation/Siltation	Rivers/Streams	426	Miles	
1	North Coast	Eel River, Middle Fork, Eel River HU, Middle Fork HA	Sedimentation/Siltation	Rivers/Streams	1071	Miles	
1	North Coast	Eel River, Middle Main Fork, Eel River HU, Middle Main HA	Sedimentation/Siltation	Rivers/Streams	674	Miles	
1	North Coast	Eel River, North Fork, Eel River HU, North Fork HA	Sedimentation/Siltation	Rivers/Streams	382	Miles	
1	North Coast	Eel River, Upper Main HA (Includes Tomki Creek)	Sedimentation/Siltation	Rivers/Streams	1141	Miles	
1	North Coast	Elk River, Eureka Plain HU	Sedimentation/Siltation	Rivers/Streams	88	Miles	
1	North Coast	Estero Americano, Bodega HU, Estero Americano HA	Sedimentation/Siltation	Estuaries	199	Acres	
1	North Coast	Freshwater Creek, Eureka Plain HU	Sedimentation/Siltation	Rivers/Streams	84	Miles	
1	North Coast	Gualala River, Mendocino Coast HU, Gualala River HA	Sedimentation/Siltation	Rivers/Streams	455	Miles	
1	North Coast	Laguna de Santa Rosa, Russian River HU, Middle Russian River HA	Sedimentation/Siltation	Rivers/Streams	96	Miles	Entire Russian River watershed (including Laguna de Santa Rosa) is listed for sedimentation.
1	North Coast	Mad River, Mad River HU	Sedimentation/Siltation	Rivers/Streams	654	Miles	
1	North Coast	Mad River, Mad River HU	Turbidity	Rivers/Streams	654	Miles	
1	North Coast	Mattole River, Cape Mendocino HU, Mattole River HA	Sedimentation/Siltation	Rivers/Streams	503	Miles	
1	North Coast	Navarro River Delta, Mendocino Coast HU, Navarro River HA	Sedimentation/Siltation	Estuaries	48	Acres	
1	North Coast	Navarro River, Mendocino Coast HU	Sedimentation/Siltation	Rivers/Streams	415	Miles	
1	North Coast	Noyo River, Mendocino Coast HU, Noyo River HA	Sedimentation/Siltation	Rivers/Streams	144	Miles	
1	North Coast	Redwood Creek, Redwood Creek HU	Sedimentation/Siltation	Rivers/Streams	332	Miles	
1	North Coast	Russian River, Russian River HU, Lower Russian River HA, Austin Creek HSA	Sedimentation/Siltation	Rivers/Streams	81	Miles	
1	North Coast	Russian River, Russian River HU, Lower Russian River HA, Guerneville HSA	Sedimentation/Siltation	Rivers/Streams	195	Miles	

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS FOR SEDIMENTATION/SILTATION AND TURBIDITY (Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
1	North Coast	Russian River, Russian River HU, Middle Russian River HA, Big Sulphur Creek HSA	Sedimentation/Siltation	Rivers/Streams	85	Miles	
1	North Coast	Russian River, Russian River HU, Middle Russian River HA, Dry Creek HSA	Sedimentation/Siltation	Rivers/Streams	255	Miles	
1	North Coast	Russian River, Russian River HU, Middle Russian River HA, Geyserville HSA	Sedimentation/Siltation	Rivers/Streams	243	Miles	
1	North Coast	Russian River, Russian River HU, Middle Russian River HA, Mark West Creek HSA	Sedimentation/Siltation	Rivers/Streams	99	Miles	
1	North Coast	Russian River, Russian River HU, Upper Russian River HA, Coyote Valley HSA	Sedimentation/Siltation	Rivers/Streams	171	Miles	
1	North Coast	Russian River, Russian River HU, Upper Russian River HA, Forsythe Creek HSA	Sedimentation/Siltation	Rivers/Streams	122	Miles	
1	North Coast	Russian River, Russian River HU, Upper Russian River HA, Ukiah HSA	Sedimentation/Siltation	Rivers/Streams	460	Miles	
1	North Coast	Santa Rosa Creek, Russian River HU, Middle Russian River HA	Sedimentation/Siltation	Rivers/Streams	87	Miles	Entire Russian River watershed (including Santa Rosa Creek) is listed for sedimentation.
1	North Coast	Scott River, Klamath River HU, Scott River HA	Sedimentation/Siltation	Rivers/Streams	902	Miles	
1	North Coast	Ten Mile River, Mendocino Coast HU, Rockport HA, Ten Mile River HSA	Sedimentation/Siltation	Rivers/Streams	162	Miles	
1	North Coast	Trinity River, East Fork, Trinity River HU, Upper HA	Sedimentation/Siltation	Rivers/Streams	92	Miles	
1	North Coast	Trinity River, South Fork, Trinity River HU, South Fork HA	Sedimentation/Siltation	Rivers/Streams	1161	Miles	
1	North Coast	Trinity River, Trinity River HU, Lower Trinity HA	Sedimentation/Siltation	Rivers/Streams	1256	Miles	
1	North Coast	Trinity River, Trinity River HU, Middle HA	Sedimentation/Siltation	Rivers/Streams	331	Miles	
1	North Coast	Trinity River, Trinity River HU, Middle HA	Sedimentation/Siltation	Rivers/Streams	331	Miles	
1	North Coast	Trinity River, Trinity River HU, Middle HA	Sedimentation/Siltation	Rivers/Streams	331	Miles	
1	North Coast	Trinity River, Trinity River HU, Upper HA	Sedimentation/Siltation	Rivers/Streams	570	Miles	
1	North Coast	Van Duzen River, Eel River HU, Van Duzen River HA	Sedimentation/Siltation	Rivers/Streams	585	Miles	
2	S. F. Bay	Butano Creek	Sedimentation/Siltation	Rivers/Streams	3.6	Miles	
2	S. F. Bay	Lagunitas Creek	Sedimentation/Siltation	Rivers/Streams	17	Miles	Tributary to Tomales Bay. Additional monitoring and assessment needed.

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS FOR SEDIMENTATION/SILTATION AND TURBIDITY (Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
2	S. F. Bay	Napa River	Sedimentation/Siltation	Rivers/Streams	65	Miles	
2	S. F. Bay	Pescadero Creek	Sedimentation/Siltation	Rivers/Streams	26	Miles	
2	S. F. Bay	Petaluma River	Sedimentation/Siltation	Rivers/Streams	22	Miles	
2	S. F. Bay	San Francisquito Creek	Sedimentation/Siltation	Rivers/Streams	12	Miles	
2	S. F. Bay	San Gregorio Creek	Sedimentation/Siltation	Rivers/Streams	11	Miles	
2	S. F. Bay	Sonoma Creek	Sedimentation/Siltation	Rivers/Streams	30	Miles	
2	S. F. Bay	Tomales Bay	Sedimentation/Siltation	Bays and Harbors	8545	Acres	Additional monitoring and assessment needed.
2	S. F. Bay	Walker Creek	Sedimentation/Siltation	Rivers/Streams	16	Miles	Tributary to Tomales Bay. Additional monitoring and assessment needed.
3	Central Coast	Aptos Creek	Sedimentation/Siltation	Rivers/Streams	8.4	Miles	
3	Central Coast	Bean Creek	Sedimentation/Siltation	Rivers/Streams	8.9	Miles	
3	Central Coast	Bear Creek(Santa Cruz County)	Sedimentation/Siltation	Rivers/Streams	6.3	Miles	
3	Central Coast	Boulder Creek	Sedimentation/Siltation	Rivers/Streams	7.6	Miles	
3	Central Coast	Branciforte Creek	Sedimentation/Siltation	Rivers/Streams	5.8	Miles	
3	Central Coast	Carbonera Creek	Sedimentation/Siltation	Rivers/Streams	10	Miles	
3	Central Coast	Carpinteria Marsh (El Estero Marsh)	Sedimentation/Siltation	Estuaries	188	Acres	
3	Central Coast	Chorro Creek	Sedimentation/Siltation	Rivers/Streams	14	Miles	
3	Central Coast	Elkhorn Slough	Sedimentation/Siltation	Estuaries	2034	Acres	
3	Central Coast	Fall Creek	Sedimentation/Siltation	Rivers/Streams	5.1	Miles	
3	Central Coast	Goleta Slough/Estuary	Sedimentation/Siltation	Estuaries	196	Acres	
3	Central Coast	Kings Creek	Sedimentation/Siltation	Rivers/Streams	4.4	Miles	
3	Central Coast	Llagas Creek	Sedimentation/Siltation	Rivers/Streams	16	Miles	Impaired section s located between Church Creek and Pajaro River
3	Central Coast	Lompico Creek	Sedimentation/Siltation	Rivers/Streams	4.5	Miles	
3	Central Coast	Los Osos Creek	Sedimentation/Siltation	Rivers/Streams	9.9	Miles	
3	Central Coast	Love Creek	Sedimentation/Siltation	Rivers/Streams	3.8	Miles	
3	Central Coast	Moro Cojo Slough	Sedimentation/Siltation	Estuaries	62	Acres	
3	Central Coast	Morro Bay	Sedimentation/Siltation	Bays and Harbors	1922	Acres	Affected area is 2300 acres.
3	Central Coast	Moss Landing Harbor	Sedimentation/Siltation	Bays and Harbors	79	Acres	
3	Central Coast	Mountain Charlie Gulch	Sedimentation/Siltation	Rivers/Streams	3.9	Miles	
3	Central Coast	Newell Creek (Upper)	Sedimentation/Siltation	Rivers/Streams	3.5	Miles	

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS FOR SEDIMENTATION/SILTATION AND TURBIDITY (Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
3	Central Coast	Pajaro River	Sedimentation/Siltation	Rivers/Streams	32	Miles	
3	Central Coast	Rider Gulch Creek	Sedimentation/Siltation	Rivers/Streams	1.8	Miles	
3	Central Coast	Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920)	Sedimentation/Siltation	Rivers/Streams	31	Miles	
3	Central Coast	Salinas River (midddle, near Gonzales Rd crossing to confluence with Nacimiento River)	Sedimentation/Siltation	Rivers/Streams	72	Miles	
3	Central Coast	Salinas River Lagoon (North)	Sedimentation/Siltation	Estuaries	197	Acres	
3	Central Coast	San Antonio Creek (South Coast Watershed)	Sedimentation/Siltation	Rivers/Streams	6.5	Miles	
3	Central Coast	San Benito River	Sedimentation/Siltation	Rivers/Streams	86	Miles	
3	Central Coast	San Lorenzo River	Sedimentation/Siltation	Rivers/Streams	27	Miles	
3	Central Coast	Santa Ynez River	Sedimentation/Siltation	Rivers/Streams	47	Miles	
3	Central Coast	Shingle Mill Creek	Sedimentation/Siltation	Rivers/Streams	1.6	Miles	
3	Central Coast	Soquel Lagoon	Sedimentation/Siltation	Estuaries	1.2	Acres	
3	Central Coast	Valencia Creek	Sedimentation/Siltation	Rivers/Streams	6.2	Miles	
3	Central Coast	Watsonville Slough	Sedimentation/Siltation	Rivers/Streams	6.2	Miles	
3	Central Coast	Zayante Creek	Sedimentation/Siltation	Rivers/Streams	9.2	Miles	
4	Los Angeles	Calleguas Creek Reach 1 (was Mugu Lagoon on 1998 303(d) list)	Sedimentation/Siltation	Estuaries	344	Acres	
4	Los Angeles	Calleguas Creek Reach 2 (estuary to Potrero Rd- was Calleguas Creek Reaches 1 and 2 on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	4.3	Miles	
4	Los Angeles	Calleguas Creek Reach 3 (Potrero Road upstream to confluence with Conejo Creek on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	3.5	Miles	
4	Los Angeles	Calleguas Creek Reach 4 (was Revolon Slough Main Branch: Mugu Lagoon to Central Avenue on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	7.2	Miles	
4	Los Angeles	Calleguas Creek Reach 5 (was Beardsley Channel on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	4.3	Miles	
4	Los Angeles	Calleguas Creek Reach 6 (was Arroyo Las Posas Reaches 1 and 2 on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	15	Miles	
4	Los Angeles	Calleguas Creek Reach 7 (was Arroyo Simi Reaches 1 and 2 on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	14	Miles	
4	Los Angeles	Calleguas Creek Reach 8 (was Tapo Canyon Reach 1)	Sedimentation/Siltation	Rivers/Streams	7.2	Miles	

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS FOR SEDIMENTATION/SILTATION AND TURBIDITY (Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
4	Los Angeles	Calleguas Creek Reach 11 (Arroyo Santa Rosa, was part of Conejo Creek Reach 3 on 1998 303d list)	Sedimentation/Siltation	Rivers/Streams	8.7	Miles	
4	Los Angeles	Las Virgenes Creek	Sedimentation/Siltation	Rivers/Streams	12	Miles	
4	Los Angeles	Malibu Creek	Sedimentation/Siltation	Rivers/Streams	11	Miles	
4	Los Angeles	Medea Creek Reach 1 (Lake to Confl. with Lindero)	Sedimentation/Siltation	Rivers/Streams	2.6	Miles	
4	Los Angeles	Medea Creek Reach 2 (Abv Confl. with Lindero)	Sedimentation/Siltation	Rivers/Streams	5.4	Miles	
4	Los Angeles	Triunfo Canyon Creek Reach 1	Sedimentation/Siltation	Rivers/Streams	2.5	Miles	
5	Central Valley	Fall River (Pit)	Sedimentation/Siltation	Rivers/Streams	8.6	Miles	
5	Central Valley	Humbug Creek	Sedimentation/Siltation	Rivers/Streams	2.2	Miles	
5	Central Valley	Panoche Creek (Silver Creek to Belmont Avenue)	Sedimentation/Siltation	Rivers/Streams	18	Miles	
6	Lahontan	Bear Creek (Placer County)	Sedimentation/Siltation	Rivers/Streams	3	Miles	
6	Lahontan	Blackwood Creek	Sedimentation/Siltation	Rivers/Streams	5.9	Miles	
6	Lahontan	Bridgeport Reservoir	Sedimentation/Siltation	Lakes/Reserviors	2614	Acres	
6	Lahontan	Bronco Creek	Sedimentation/Siltation	Rivers/Streams	1.3	Miles	
6	Lahontan	Clearwater Creek	Sedimentation/Siltation	Rivers/Streams	12	Miles	
6	Lahontan	East Walker River, below Bridgeport Reservoir	Sedimentation/Siltation	Rivers/Streams	8	Miles	
6	Lahontan	Goodale Creek	Sedimentation/Siltation	Rivers/Streams	12	Miles	Potential for delisting following further monitoring.
6	Lahontan	Gray Creek (Nevada County)	Sedimentation/Siltation	Rivers/Streams	2.8	Miles	
6	Lahontan	Heavenly Valley Creek (USFS boundary to Trout Creek)	Sedimentation/Siltation	Rivers/Streams	1.4	Miles	
6	Lahontan	Horseshoe Lake (San Bernardino County)	Sedimentation/Siltation	Lakes/Reserviors	31	Acres	Further monitoring may permit delisting.
6	Lahontan	Hot Springs Canyon Creek	Sedimentation/Siltation	Rivers/Streams	2.9	Miles	Listed on basis of limited data; further monitoring may support delisting.
6	Lahontan	Mill Creek (Modoc County)	Sedimentation/Siltation	Rivers/Streams	4.2	Miles	Creek needs monitoring to determine current extent of impairment and need for TMDL.
6	Lahontan	Pine Creek (Lassen County)	Sedimentation/Siltation	Rivers/Streams	55	Miles	
6	Lahontan	Squaw Creek	Sedimentation/Siltation	Rivers/Streams	5.8	Miles	
6	Lahontan	Tahoe, Lake	Sedimentation/Siltation	Lakes/Reserviors	85364	Acres	
6	Lahontan	Topaz Lake	Sedimentation/Siltation	Lakes/Reserviors	928	Acres	Additional monitoring and assessment needed to document extent of impairment.

2002 CWA SECTION 303(d) LIST OF WATER QUALITY LIMITED SEGMENTS
FOR SEDIMENTATION/SILTATION AND TURBIDITY
(Approved by USEPA – July 2003)

Regional Board No.	Regional Board	Water Body Name	Pollutant_Stressor	Water Body Type	Est. Size Affected	Unit	Comments
6	Lahontan	Truckee River	Sedimentation/Siltation	Rivers/Streams	39	Miles	
6	Lahontan	Ward Creek	Sedimentation/Siltation	Rivers/Streams	5.7	Miles	
6	Lahontan	West Walker River	Sedimentation/Siltation	Rivers/Streams	49	Miles	
6	Lahontan	Wolf Creek (Alpine County)	Sedimentation/Siltation	Rivers/Streams	12	Miles	
7	Col. R. Basin	Imperial Valley Drains	Sedimentation/Siltation	Rivers/Streams	1222	Miles	
7	Col. R. Basin	New River (Imperial)	Sedimentation/Siltation	Rivers/Streams	66	Miles	
8	Santa Ana	Big Bear Lake	Sedimentation/Siltation	Lakes/Reserviors	2865	Acres	
8	Santa Ana	Rathbone (Rathbun) Creek	Sedimentation/Siltation	Rivers/Streams	4.7	Miles	
9	San Diego	Agua Hedionda Lagoon	Sedimentation/Siltation	Estuaries	6.8	Acres	
9	San Diego	Buena Vista Lagoon	Sedimentation/Siltation	Estuaries	202	Acres	
9	San Diego	Los Penasquitos Lagoon	Sedimentation/Siltation	Estuaries	469	Acres	
9	San Diego	Prima Deshecha Creek	Turbidity	Rivers/Streams	1.2	Miles	
9	San Diego	San Elijo Lagoon	Sedimentation/Siltation	Estuaries	566	Acres	Estimated size of impairment is 150 acres.
9	San Diego	Segunda Deshecha Creek	Turbidity	Rivers/Streams	0.92	Miles	

Instructions for Identifying Coordinates on 303(d) Maps

1. From the folder title, 303d GIS Maps, on the enclosed CD, copy GIS files to your local (project) directory.

2. From CD, copy the file titled, latlong.avx (\gis\AV Extension), to the EXT32 folder where you have ArcView installed…typically in the directory:

   C:\ESRI\AV_GIS30\ARCVIEW\EXT32

3. Open ArcView

4. Add themes to a view

5. Go to File>Extensions and load Longitude/Latitude Conversion Utility (refer to screenshot in Figure A-1.)

6. Activate the Longitude/Latitude Conversion Utility by clicking on the button (refer to screenshot in Figure A-2.)

7. Click anywhere in the view to get lat/long coordinates of a point (refer to screenshot in Figure A-3.)

8. After selecting a point on the screen, the message shown on Figure A-3 will appear. If you'd like to add the point to the screen, then click *Yes*; otherwise, click *No*

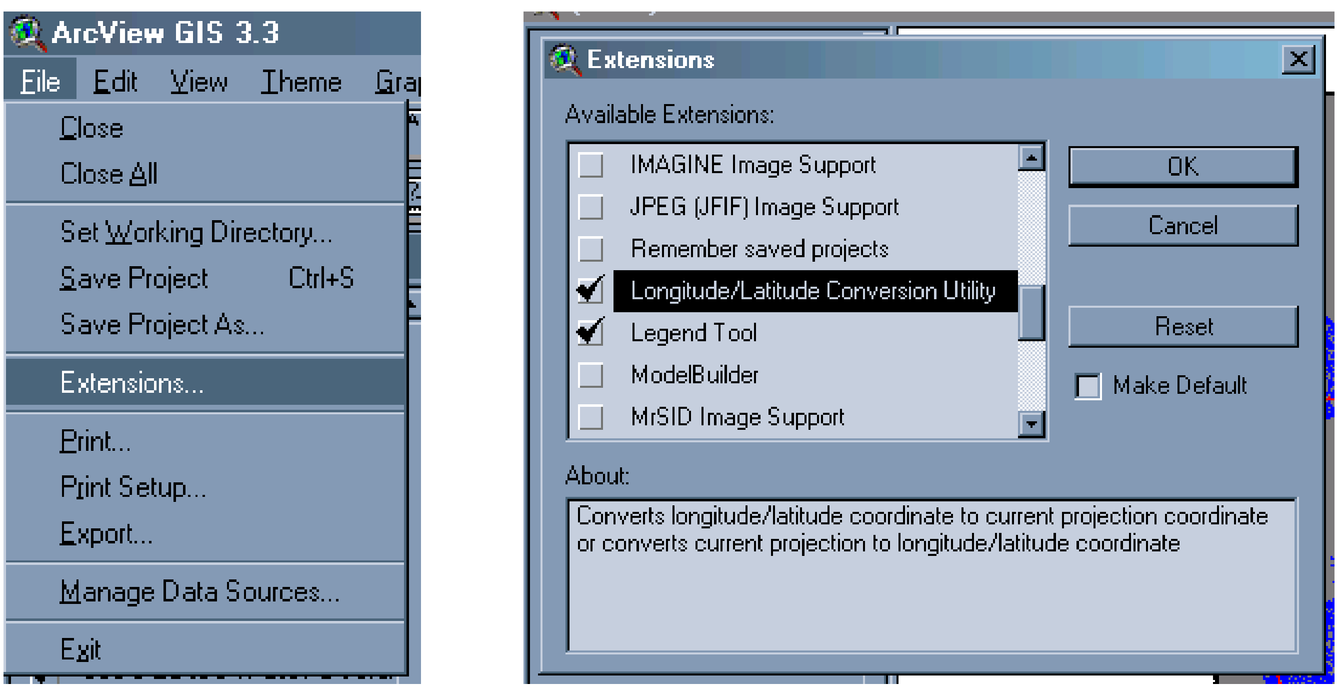
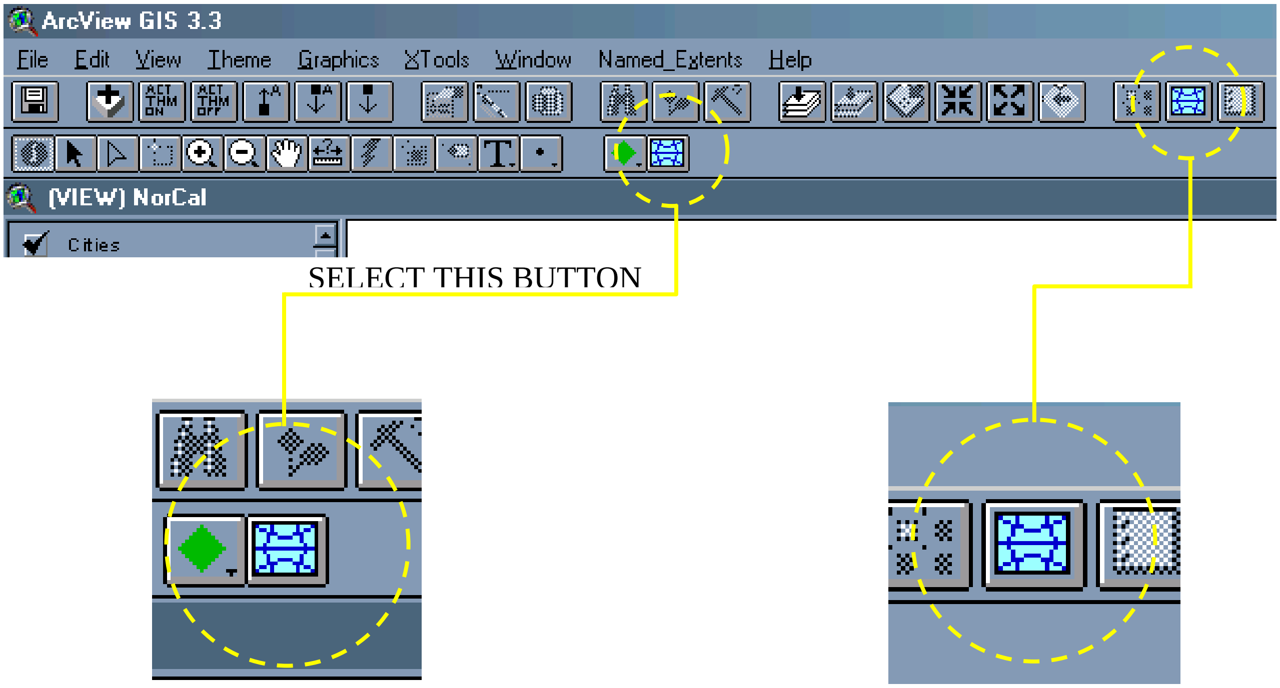


Figure A-1. Step 5 Screenshot



Displays Lat/Long of Selected Point on screen

Converts Lat/Long to current projection coordinate

Figure A-2. Step 6 Screenshot

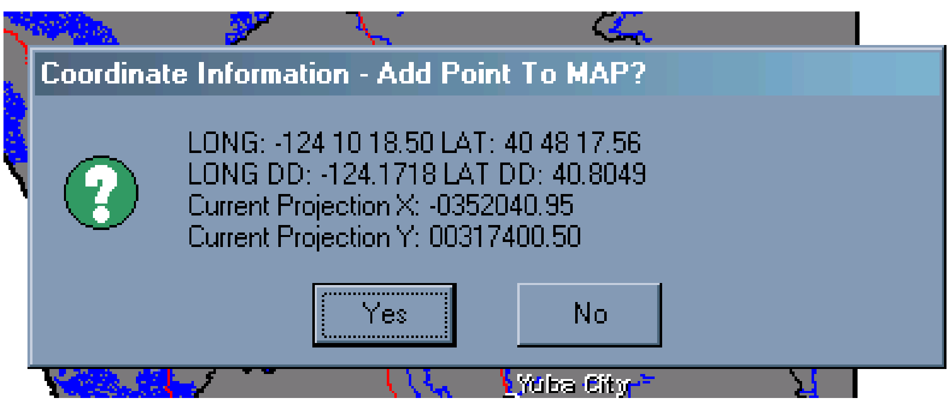
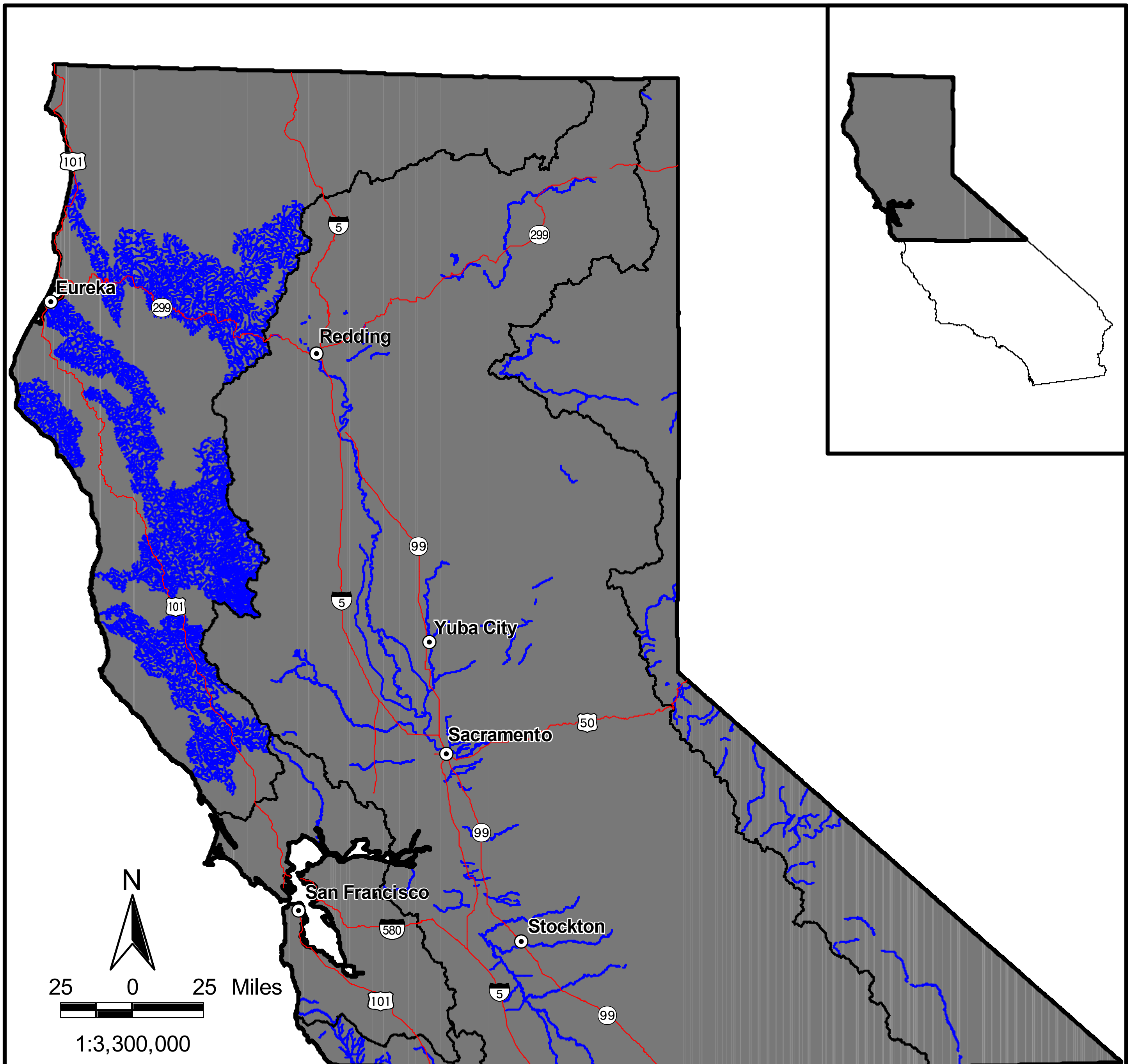


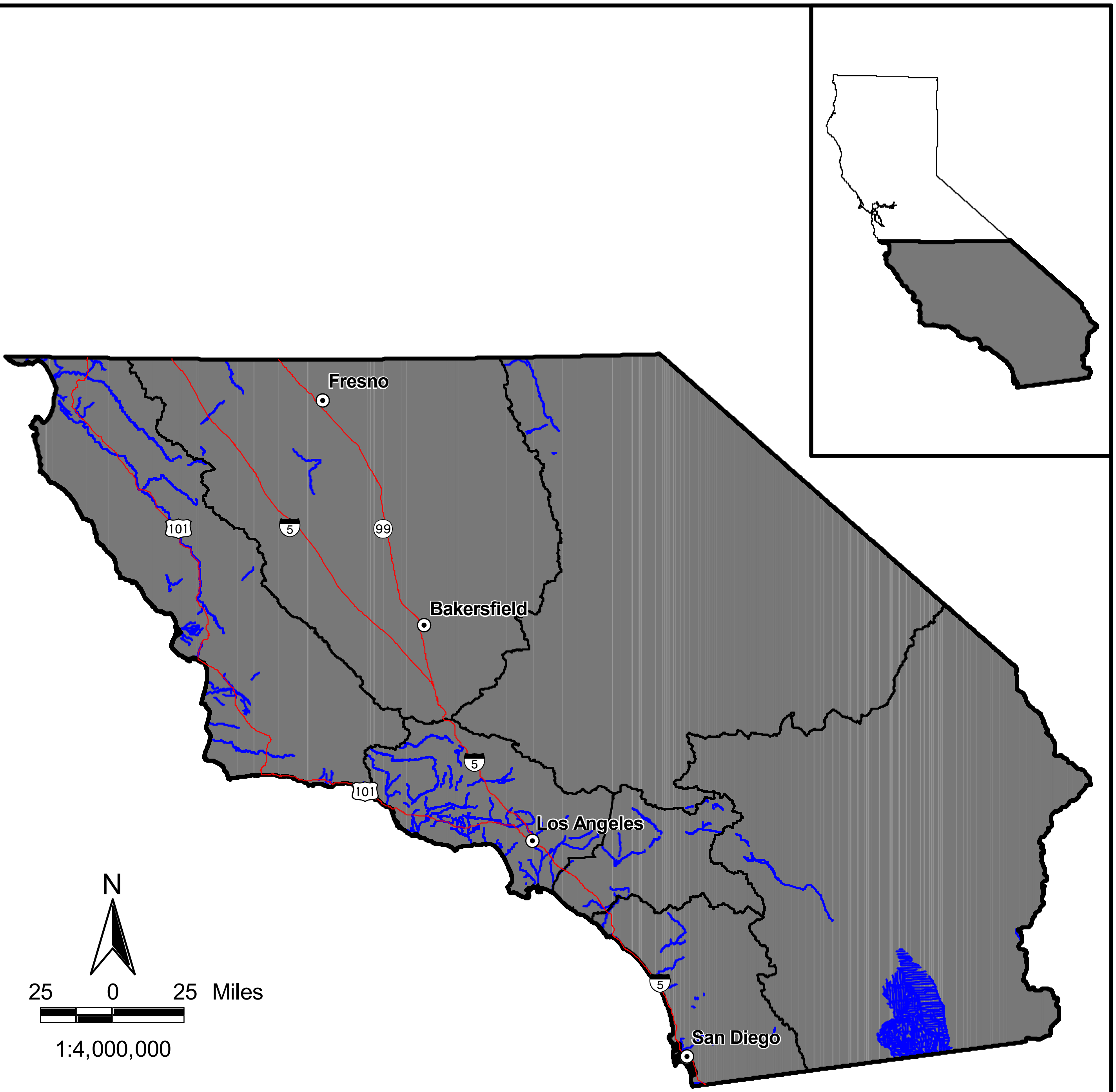
Figure A-3. Step 7 Screenshot



DISCLAIMER:
The 2002 303(d) GIS files were created for reporting purposes by the SWRCB and RWQCB's. These GIS representations of the areal extent of affected waters are only an estimate and should not be considered authorative for the development of TMDLs or other regulatory actions. The TMDL (Total Maximum Daily Load) effort may ultimately address more or less area. Mapping the 303(d) listed waters is a work in progress and will be updated during each listing cycle to better define the impacted areas.

Regional Water Quality Control Board Districts

303d Listed Water Bodies for Sedimentation, Siltation, or Turbidity



DISCLAIMER:
The 2002 303(d) GIS files were created for reporting purposes by the SWRCB and RWQCB's. These GIS representations of the areal extent of affected waters are only an estimate and should not be considered authorative for the development of TMDLs or other regulatory actions. The TMDL (Total Maximum Daily Load) effort may ultimately address more or less area. Mapping the 303(d) listed waters is a work in progress and will be updated during each listing cycle to better define the impacted areas.

Regional Water Quality Control Board Districts

303d Listed Water Bodies for Sedimentation, Siltation, or Turbidity

Appendix B

Section 600.4, Sampling and Analysis Plan for Sediment

Section 600.5, Sampling and Analysis Plan for Non-Visible Pollutants

SWPPP/WPCP Preparation Manual (March 2003)

600.4 Sampling and Analysis Plan for Sediment

INSTRUCTIONS:

- If the project has the potential to discharge directly into a water body listed as impaired due to Sedimentation/Siltation and/or Turbidity pursuant to Section 303(d) of the Clean Water Act, the SWPPP must include a Sampling and Analysis Plan (SAP) for Sediment. The purpose of a SAP for Sediment is to determine if BMPs implemented on the construction site are effective for preventing impacts to levels of sedimentation/siltation and/or turbidity in 303(d) listed water bodies impaired by those pollutants.
- Include the following required text to identify whether or not the project discharges directly to a 303(d) listed water body.

REQUIRED TEXT:

This project [does/ does not] have the potential to discharge directly to a water body listed as impaired due to Sedimentation/Siltation and/or Turbidity pursuant to Clean Water Act, Section 303(d).

INSTRUCTIONS:

- If the project does not discharge to a 303(d) listed water body, delete Sections 600.4.1 through 600.4.9 from the template and continue with Section 600.5.
- If the project does discharge to a 303(d) listed water body, complete Sections 600.4.1 through 600.4.9 by following the instructions provided at the beginning of each section.

600.4.1 Scope of Monitoring Activities

INSTRUCTIONS:

- ❑ Provide the name(s) of the 303(d) listed water bodies and identify the reason for impairment. (Sedimentation/Siltation and/or Turbidity)
- ❑ Describe the location(s) of direct discharge from the project site to the 303(d) water body and show the locations of direct discharge on the WPCDs.
- ❑ Include the appropriate required text to identify whether run-on to the Caltrans right-of-way may combine with storm water and directly discharge to the 303(d) water body. If the project does receive run-on, describe the locations of run-on and show the locations on the WPCDs.

REQUIRED TEXT:

This project discharges directly into [specify 303(d) water body], a water body listed as impaired due to [specify reason(s) for impairment: Sedimentation/Siltation and/or Turbidity] pursuant to Clean Water Act, Section 303(d). This Sampling and Analysis Plan (SAP) has been prepared pursuant to the requirements of Resolution 2001-046 and the applicable sections of the Caltrans *Guidance Manual: Stormwater Monitoring Protocols* (Second Edition, July 2000). The SAP describes the sampling and analysis strategy and schedule for monitoring [specify impairment: Sedimentation/Siltation and/or Turbidity] in the 303(d) listed water body and potential increases in the [specify impairment: Sedimentation/Siltation and/or Turbidity] levels caused by storm water discharges from the project site.

The project has the potential for direct (concentrated) storm water discharges to [specify 303(d) water body] at the following locations, as shown on the WPCDs in Attachment B.

-
-
-

REQUIRED TEXT for PROJECTS that do not RECEIVE RUN-ON:

The project does not receive run-on with the potential to combine with storm water that discharges directly to the 303(d) listed water body.

REQUIRED TEXT for PROJECTS that RECEIVE RUN-ON:

The project receives run-on with the potential to combine with storm water that discharges directly to the 303(d) listed water body at the following locations, as shown on the WPCDs in Attachment B:

-
-
-

600.4.2 Monitoring Strategy

INSTRUCTIONS:

- ❑ Describe the sampling schedule for monitoring the impacts of direct storm water discharges to the 303(d) water body.
- ❑ Describe the sampling locations for monitoring the impacts of direct storm water discharges from the project to the 303(d) water body.
- ❑ Describe the rationale for the selection of sampling locations.
- ❑ Identify a location upstream of all direct discharge from the construction site that appears to represent the flow of the water body, to analyze the prevailing condition of the receiving water without any influence from the construction site. Describe exactly, either using GPS coordinates of post kilometer/post mile, where the sample will be collected. Note: Sampling too far upstream may not show prevailing conditions immediately upstream of the construction site.
- ❑ Identify a location immediately downstream from the last point of direct discharge from the construction site that appears to represent the nature of the flow to analyze potential impacts to the 303(d) listed water body from the project. Describe exactly where the sample will be collected. Downstream samples should represent the receiving water mixed with flow from the construction site. Note: Sampling too far downstream may detect pollutants from other discharges.

- ❑ For projects that, in Section 600.4.1, identified locations of run-on to the Caltrans right-of-way, include the required text to identify run-on sampling location(s) to determine potential impairments that originate off the project site. Describe exactly where the sample will be collected.
- ❑ Show all sampling locations on the WPCDs.

- ■ Locate sampling locations in areas that are safe, out of the path of heavy traffic, and reasonably accessible.
  - ❑ Describe surrounding areas such as agricultural fields, or other sites that may contribute run-on sediment to the site.
  - ❑ Do not locate sampling points upstream or downstream of point sources or confluences to minimize backwater effects or poorly mixed flows.

REQUIRED TEXT:

Sampling Schedule

Upstream, downstream, discharge, and run-on samples, if applicable, shall be collected for [specify impairment: Sedimentation/Siltation and/or Turbidity] during the first two hours of discharge from rain events that result in a direct discharge from the project site to [enter 303(d) water body]. Samples shall be collected during daylight hours (sunrise to sunset) and shall be collected regardless of the time of the year, status of the construction site, or day of the week.

All storm events that occur during daylight hours will be sampled up to a maximum of four rain events within a 30-day period. In conformance with the U.S. Environmental Protection Agency definition, a minimum of 72 hours of dry weather will be used to distinguish between separate rain events.

Sampling Locations

Sampling locations are based on proximity to identified discharge or run-on location(s), accessibility for sampling, personnel safety, and other factors in accordance with the applicable requirements in the Caltrans *Guidance Manual: Stormwater Monitoring Protocols*. Sampling locations are shown on the WPCDs and include:

- A sample location **(**designated number) is upstream of all direct discharge from the construction site for the collection of a control sample to be analyzed for the prevailing condition of the receiving water without any influence from the construction site. The control sample will be used to determine the background levels of [specify impairment: Sedimentation/Siltation and/or Turbidity] in the 303(d) listed water body upstream of the project, if any.
  - o Sample location number is located .
- A sample location **(**designated number) is immediately downstream from the last point of direct discharge from the construction site for the collection of a sample to be analyzed for potential increases in [specify impairment: Sedimentation/Siltation and/or

Turbidity] in the 303(d) listed water body caused by storm water discharges from the project, if any.

- o Sample location number is located .

REQUIRED TEXT only for PROJECTS that RECEIVE RUN-ON:

- [Enter number of locations] sampling location(s) (designated number(s)) has been identified for the collection of samples of run-on to the Caltrans right-of-way with the potential to combine with discharges from the construction site in other than MS4 to the 303(d) water body. These samples will identify potential [specify impairment: Sedimentation/Siltation and/or Turbidity] that originates off the project site and contributes to direct storm water discharges from the construction site to the 303(d) listed water body.

If the following is not "needed", place cursor in a field and use the "Delete Line" option on the toolbar.

- o Sample location number is located .
- o If needed Sample location number is located .
- o If needed Sample location number is located .

600.4.3 Monitoring Preparation

INSTRUCTIONS:

- Training of water quality sampling personnel shall be in accordance with the Caltrans *Guidance Manual: Stormwater Monitoring Protocols, Second Edition, July 2000*, CTSW-RT-00-005.
  - ❑ Identify whether samples will be collected by the contractor's personnel, by a commercial laboratory, or by an environmental consultant.
  - ❑ Identify training and experience of individuals responsible for collecting water samples
  - ❑ Identify the contractor's health and safety procedures for sampling personnel.
  - ❑ Identify alternate sampling personnel in case of emergency, sick leave, and/or vacations during storm water monitoring. Identify training of alternate sampling personnel.
  - ❑ Identify the state-certified laboratory(ies) that will analyze the samples. For a the list of California state-certified laboratories that are accepted by Caltrans, access the following web site: www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm
  - ❑ Include the appropriate required text to describe the strategy for ensuring that adequate sample collection supplies are available to the project in preparation for a sampling event.
  - ❑ Describe the strategy for ensuring that appropriate field-testing equipment is available to the project in preparation for a sampling event. If equipment is to be rented, contact a local environmental equipment rental company, such as www.totalsafetyinc.com.

REQUIRED TEXT IF contractor personnel will collect samples:

Samples on the project site will [be collected/ not be collected] by contractor sampling personnel:

Name/Telephone Number:	Name Phone Number
Name/Telephone Number:	Name Phone Number
Alternate(s)/Telephone Number:	Name Phone Number
Alternate(s)/Telephone Number:	Name Phone Number

Prior to the rainy season, all sampling personnel and alternates will review the SAP. Qualifications of designated contractor personnel describing environmental sampling training and experience are provided in Attachment I.

An adequate stock of supplies and equipment for monitoring [specify impairment: Sedimentation/Siltation and/or Turbidity] will be available on the project site or provided by [specify laboratory] prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight. Sampling personnel will be available to collect samples in accordance with the sampling schedule.

Supplies maintained at the project site will include, but will be not limited to, surgical gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, Sampling Activity Log forms, and Chain of Custody (COC) forms.

The contractor will obtain and maintain the field-testing instruments, as identified in Section 600.4.5, for analyzing samples in the field by contractor sampling personnel. Safety practices for sample collection will be in accordance with the [enter title and publication date of contractor health and safety plan for the project].

REQUIRED TEXT only If consultant or laboratory will collect samples:

Samples on the project site will be collected by the following [specify laboratory or environmental consultant]:

Company Name:
Address:

Telephone Number:
Point of Contact:

Qualifications of designated sampling personnel describing environmental sampling training and experience are provided in Attachment I.

WPCM will contact [specify name of laboratory or environmental consultant] [enter number of hours] hours prior to a predicted rain event to ensure that adequate sample collection personnel, supplies and field test equipment for monitoring [specify impairment: Sedimentation/Siltation and/or Turbidity] are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.

[Specify name of laboratory or environmental consultant] will obtain and maintain the field-testing instruments, as identified in Section 600.4.5, for analyzing samples in the field by their sampling personnel.

600.4.4 Sample Collection and Handling

INSTRUCTIONS:

- ❑ Describe sample collection procedures to be used on the project. For sample collection procedures, refer to the Caltrans Guidance Manual: Stormwater Monitoring Protocols (Second Edition, July 2000) for general guidance.

- ■ Run-on samples may be collected using the following collection procedures or other approved by the RE:

- \- Place several rows of sand bags in a half circle directly in the path of the run-on to pond water and wait for enough water to spill over. Then place a cleaned or decontaminated flexible hose along the top and cover with another sandbag so that ponded water will only pour through the flexible hose and into sample bottles. Do not reuse the same sandbags in future sampling events as they may cross-contaminate future samples.

- \- Place a cleaned or decontaminated dustpan with open handle in the path of the run-on so that water will pour through the handle and into sample bottles.

- ■ For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136.

- ■ For a the list of California state-certified laboratories that are accepted by Caltrans, access the following web site: www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm

- ❑ Describe sample handling procedures.

- ❑ Describe decontamination waste disposal requirements (i.e., TSP soapy water shall not to be discharged to the storm drainage system or receiving water)

- ❑ Describe sample collection documentation procedures.

- ❑ Describe procedures for recording and correcting sampling data.

- ■ A Chain of Custody (COC) form is required to be submitted to the laboratory with the samples to trace the possession and handling of samples from collection through analysis.

- ■ A Sampling Activity Log is required to document details of all sampling events and to record results for samples analyzed in the field.

- ■ Each sample bottle is required to have a proper and complete identification label.

REQUIRED TEXT:

Sample Collection Procedures

Grab samples will be collected and preserved in accordance with the methods identified in Table 600-1, "Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation and/or Turbidity", provided in section 600.4.5. Only personnel trained in proper water quality sampling will collect samples.

Upstream samples will be collected to represent the condition of the water body upgradient of the construction site. Downstream samples will be collected to represent the water body mixed with direct flow from the construction site. Samples will not be collected directly from ponded, sluggish, or stagnant water.

Upstream and downstream samples will be collected using one of the following methods:

- Placing a sample bottle directly into the stream flow in or near the main current upstream of sampling personnel, and allowing the sample bottle to fill completely;

  OR,

- Placing a decontaminated or 'sterile' bailer or other 'sterile' collection device in or near the main current to collect the sample, and then transferring the collected water to appropriate sample bottles, allowing the sample bottles to fill completely.

Run-on samples, if applicable, will be collected to identify potential sedimentation/siltation and/or turbidity that originates off the project site and contributes to direct discharges from the construction site to the 303(d) listed water body. Run-on samples will be collected downgradient and within close proximity of the point of run-on to the project by pooling or ponding water and allowing the ponded water to spill over into sample bottles directly in the stream of water.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Wear a clean pair of surgical gloves prior to the collection and handling of each sample at each location.
- Not contaminate the inside of the sample bottle by not allowing it to come into contact with any material other than the water sample.
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection.
- Not leave the cooler lid open for an extended period of time once samples are placed inside.
- Not touch the exposed end of a sampling tube, if applicable.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Not eat, smoke, or drink during sample collection.

- Not sneeze or cough in the direction of an open sample bottle.
- Minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample to take place.
- Decontaminate sampling equipment prior to sample collection using a TSP-soapy water wash, distilled water rinse, and final rinse with distilled water.
- Dispose of decontamination water/soaps appropriately; i.e., not discharge to the storm drain system or receiving water

Sample Handling Procedures

REQUIRED TEXT only If laboratory will analyze ALL or SOME OF THE samples:

Immediately following collection, sample bottles for laboratory analytical testing will be capped, labeled, documented on a Chain of Custody (COC) form provided by the analytical laboratory, sealed in a re-sealable plastic storage bag, placed in an ice-chilled cooler, at as near to 4 degrees Celsius as practicable, and delivered within 24 hours to the following California state-certified laboratory:

Laboratory Name:
Address:

Telephone Number:
Point of Contact:

REQUIRED TEXT only If contractor will analyze ALL OR SOME OF THE samples:

Immediately following collection, samples for field analysis will be tested in accordance with the field instrument manufacturer's instructions and results recorded on the Sampling Activity Log.

REQUIRED TEXT:

Sample Documentation Procedures

All original data documented on sample bottle identification labels, Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated. Copies of the Chain of Custody form and Sampling Activity Log are provided in Attachment I. Sampling and field analysis activities will be documented using the following:

- Sample Bottle Identification Labels: Sampling personnel will attach an identification label to each sample bottle. At a minimum, the following information will be recorded on the label, as appropriate:
  - Project name
  - Project number
  - Unique sample identification number and location.

    [Caltrans Number]-[Six digit sample collection date]-[Location]

    (*Example:* 07-0G5304-081801-Upstream).

    Quality assurance/quality control (QA/QC) samples shall be identified similarly using a unique sample number or designation

    (*Example*: 07-0G5304-081801-DUP1).
  - Collection date/time (No time applied to QA/QC samples)
  - Analysis constituent

  - Sampling Activity Logs: A log of sampling events will identify:
    - Sampling date
    - Separate times for sample collection of upstream, downstream, run-on, and QA/QC samples recorded to the nearest minute
    - Unique sample identification number and location
    - Analysis constituent
    - Names of sampling personnel
    - Weather conditions (including precipitation amount)
    - Field analysis results
    - Other pertinent data

- Chain of Custody (COC) forms: All samples to be analyzed by a laboratory will be accompanied by a COC form provided by the laboratory. Only the sample collectors will sign the COC form over to the lab. COC procedures will be strictly adhered to for QA/QC purposes.
- Storm Water Quality Construction Inspection Checklists: When applicable, the contractor's storm water inspector will document on the checklist that samples for sedimentation/siltation and/or turbidity were taken during a rain event.

600.4.5 Sample Analysis

INSTRUCTIONS:

- ❑ Identify the tests to be used on the project by completing Table 600-1, "Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation and/or Turbidity".
- ❑ For 303(d) listed water bodies impaired due to Sedimentation/Siltation, select YES for (b) and (c) OR YES for (b), and (c) and/or (a).
- ❑ For 303(d) listed water bodies impaired due to Turbidity, select YES for (d).

❑ For each test selected, fill in the blank fields in the table. Contact the selected laboratory for the specifications to obtain the necessary information.

REQUIRED TEXT:

Samples will be analyzed for the constituents indicated in Table 600-1, “Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation and/or Turbidity”.

TABLE 600-1

Sample Collection, Preservation and Analysis for Monitoring Sedimentation/Siltation and/or Turbidity

Constituent [1]	Analytical Method	Test to be Used?	Sample Preservation	Minimum Sample Volume	Sample Bottle	Maximum Holding Time	Reporting Limit
(a) Suspended Sediment Concentration (SSC)	ASTM D3977-97	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)				
(b) Settleable Solids (SS)	EPA 160.5 Std Method 2540(f)	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)				mL/L/hr
(c) Total Suspended Solids (TSS)	EPA 160.2 Std Method 2540(d)	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)				mg/L
(d) Turbidity	EPA 180.1 Std Method 2130(b)	☐ YES ☐ NO	Store at 4˚ C (39.2˚ F)				NTU

Notes: [1] **Samples shall be analyzed by using methods (b) and (c), or only method (a)**

ASTM – American Society for Testing and Materials
°C – Degrees Celsius
°F – Degrees Fahrenheit
EPA – U.S. Environmental Protection Agency
L – Liter
mL/L/hr – Milliliters per liter per hour
mg/L – Milligrams per liter
mL – Milliliters
NTU – Nephelometric Turbidity Unit
Std Method – Per the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, American Water Works Association

REQUIRED TEXT only If samples will be analyzed in the field:

For samples collected for field analysis, collection, analysis and equipment calibration will be in accordance with the field instrument manufacturer's specifications.

The following field instrument(s) will be used to analyzed the following constituents:

Field Instrument	Constituent

- The instrument(s) will be maintained in accordance with manufacturer's instructions.
- The instrument(s) will be calibrated before each sampling and analysis event.
- Maintenance and calibration records will be maintained with the SWPPP.

600.4.6 Quality Assurance/Quality Control

REQUIRED TEXT:

For an initial verification of laboratory or field analysis, duplicate samples will be collected at a rate of 10 percent or 1 duplicate per sampling event. The duplicate sample will be collected, handled, and analyzed using the same protocols as primary samples, and will be collected where contaminants are likely, and not on the upstream sample. A duplicate sample will be collected immediately after the primary sample has been collected. Duplicate samples will not influence any evaluations or conclusions; however, they will be used as a check on laboratory quality assurance.

600.4.7 Data Management and Reporting

INSTRUCTIONS:

- ❑ Electronic data results shall be provided to the RE, unless he/she provides the name, company and e-mail address of the person to whom the data should be submitted.

REQUIRED TEXT:

A copy of all water quality analytical results and QA/QC data will be submitted to the Resident Engineer within 5 days of sampling (for field analyses) and within 30 days of sampling (for laboratory analyses).

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. Electronic data shall be reported in a format consistent with Caltrans *Water Quality Data Reporting Protocol* dated October 2001.

Lab reports and COCs will be reviewed for consistency between lab methods, sample identifications, dates, and times for both primary samples and QA/QC samples. All data, including COC forms and Sampling Activity Logs, shall be kept with the SWPPP document.

Electronic results will be e-mailed to [Name] of [Company] at [e-mail address] after final sample results are received after each sampling event for inclusion into a statewide database.

600.4.8 Data Evaluation

INSTRUCTIONS:

- The General Permit requires that BMPs be implemented on the construction site to prevent a net increase of sediment load in storm water discharges relative to pre-construction levels. The upstream sample, while not representative of pre-construction levels, provides a basis for comparison with the sample collected downstream of the construction site.
- The downstream water quality sample analytical results will be evaluated to determine if the downstream sample(s) show elevated levels of the tested constituent relative to the levels found in the upstream sample. The run-on sample analytical results will be used as an aid in evaluating potential offsite influences on water quality results. If elevated levels of pollutants are identified, additional BMPs must be implemented in an iterative manner to prevent a net increase in pollutants to receiving waters.

REQUIRED TEXT:

An evaluation of the water quality sample analytical results, including figures with sample locations, will be submitted to the Resident Engineer with the water quality analytical results and the QA/QC data for every event that samples are collected. Should the downstream sample concentrations exceed the upstream sample concentrations, the WPCM or other personnel will evaluate the BMPs, site conditions, surrounding influences (including run-on sample analysis), and other site factors to determine the probable cause for the increase. As determined by the data and project evaluation, appropriate BMPs will be repaired or modified to mitigate increases in sediment concentrations in the water body. Any revisions to the BMPs will be recorded as an amendment to the SWPPP.

600.4.9 Change of Conditions

REQUIRED TEXT:

Whenever SWPPP monitoring, pursuant to Section B of the General Permit, indicates a change in site conditions that might affect the appropriateness of sampling locations, testing protocols will be revised accordingly. All such revisions will be recorded as amendments to the SWPPP.

600.5 Sampling and Analysis Plan for Non-Visible Pollutants

INSTRUCTIONS:

- The project SWPPP must include a Sampling and Analysis Plan (SAP) for pollutants not visually detectable in storm water. The purpose of a SAP for Non-Visible Pollutants is to determine if BMPs implemented on the construction site are effective in preventing pollutants not visually detectable in storm water, from leaving the construction site and potentially impacting water quality objectives.

REQUIRED TEXT:

This Sampling and Analysis Plan (SAP) for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in storm water discharges from the project site and offsite activities directly related to the project in accordance with the requirements of Section B of the General Permit, including modifications, and applicable requirements of the Caltrans *Guidance Manual: Stormwater Monitoring Protocols*, Second Edition (July 2000).

600.5.1 Scope of Monitoring Activities

INSTRUCTIONS:

- ❑ Identify the general sources and locations of potential non-visible pollutants on the project site in the following categories:

- Materials or wastes as identified in Section 500.3.1, containing potential non-visible pollutants and that are not stored under watertight conditions.
- Materials or wastes containing potential non-visible pollutants that are stored under watertight conditions, but (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.
- Construction activities such as application of fertilizers, pesticides, herbicides or non-pigmented curing compounds, that have occurred during a rain event or within 24 hours preceding a rain event, and there is the potential for discharge of pollutants to surface waters or drainage system.
- Existing site features contaminated with non-visible pollutants as identified in Section 500.3.3.
- Applications of soil amendments, including soil stabilization products, with the potential to alter pH levels or other properties of the soil (such as chemical properties, engineering properties, or erosion resistance), or contribute toxic pollutants to storm water runoff, and there is the potential for discharge of pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentration levels of non-visible pollutants in the soil amendment.)
  - Certain soil amendments, when sprayed on straw or mulch, are considered visible pollutants and are not subject to water quality monitoring requirements.
- Storm water runoff from an area contaminated by historical usage of the site is observed to combine with storm water, and there is the potential for discharge of pollutants to surface waters or drainage system.
- Storm water run-on to the Caltrans right-of-way with the potential to contribute non-visible pollutants to discharges from the project.

- Breaches, malfunctions, leakages, or spills from a BMP

EXAMPLE:

The following construction materials, wastes, or activities, as identified in Section 500.3.1, are potential sources of non-visible pollutants to storm water discharges from the project. Storage, use, and operational locations are shown on the WPCDs in Attachment B.

- Solvents, thinners
- Concrete curing
- Treated wood
- Soil stabilizers
- Lime treated subgrade
- Fertilizers, herbicides, and pesticides

The following existing site features, as identified in Section 500.3.3, are potential sources of non-visible pollutants to storm water discharges from the project. Locations of existing site features contaminated with non-visible pollutants are shown on the WPCDs in Attachment B.

- Southwest portion of the construction site was previously used as a municipal landfill until 1987 and may have volatile organics in the soil.
- North portion of the construction site was a storage area for a metal plating shop until 1960 and may have metals in the soil.

The following soil amendments have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil and will be used on the project site. Locations of soil amendment application are shown on the WPCDs in Attachment B.

- None

The project has the potential to receive storm water run-on with the potential to contribute non-visible pollutants to storm water discharges from the project. Locations of such run-on to the Caltrans right of way are shown on the WPCDs in Attachment B.

- One location down gradient of the Millenium Chemical Company chemical plant and the Progress Industrial Park is identified as a run-on location to the construction site.
- Two locations are identified as run-on locations along the eastern edge of the construction site boundary.
- The northern boundary of the construction site has one location where run-on is likely.

REQUIRED TEXT:

The following construction materials, wastes or activities, as identified in Section 500.3.1, are potential sources of non-visible pollutants to storm water discharges from the project. Storage, use, and operational locations are shown on the WPCDs in Attachment B.

- (LIST)
-

-

The following existing site features, as identified in Section 500.3.3, are potential sources of non-visible pollutants to storm water discharges from the project. Locations of existing site features contaminated with non-visible pollutants are shown on the WPCDs in Attachment B.

- (DESCRIBE)
-
-

The following soil amendments have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil and will be used on the project site. Locations of soil amendment application are shown on the WPCDs in Attachment B.

- (LIST)
-
-

The project has the potential to receive storm water run-on with the potential to contribute non-visible pollutants to storm water discharges from the project. Locations of such run-on to the Caltrans right-of-way are shown on the WPCDs in Attachment B.

- (LIST LOCATIONS)
-
-

Sampling for non-visible pollutants will be conducted when (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

600.5.2 Monitoring Strategy

INSTRUCTIONS:

- ❑ Describe the sampling schedule for monitoring potential non-visible pollutants in storm water runoff. Note the specific conditions under which a sampling event for non-visible pollutants is triggered.
- ❑ Describe the sampling locations for monitoring non-visible pollutants.
- ❑ Describe the rationale for the selection of sampling locations.

- ❑ Identify a location for collecting samples of storm water runoff from each source location of non-visible pollutant identified in Section 600.5.1. Describe exactly where the sample will be collected.
- ❑ Identify a location for collecting an uncontaminated background sample of runoff that has not come into contact with the non-visible pollutants identified in Section 600.5.1 or disturbed soil areas of the project. Describe exactly where the sample will be collected.
- ❑ Identify a location for collecting samples of storm water run-on from each of the locations identified in Section 600.5.1 to identify possible sources of contamination that may originate from off the project site. Describe exactly where the sample will be collected.
- ❑ Identify sampling locations at offsite activities directly related to the project such as; storage areas, in the contractor's yard, PCC or asphalt batch plants, whether or not they are located within the Caltrans right of way.
- ❑ Show all sampling locations on the WPCDs.
- ❑ Locate sampling locations in areas that are safe, out of the path of heavy traffic, and have attainable access.
- ❑ Describe or list surrounding areas, such as industrial sites, that may contribute run-on or airborne constituents to the site.
- ❑ If no inspections of the site are performed prior to or during a rain event, monitoring and sampling of <u>all</u> non-visible pollutants will be required.

REQUIRED TEXT:

<u>**Sampling Schedule**</u>

Samples for the applicable non-visible pollutant(s) and a sufficiently large uncontaminated background sample shall be collected during the first two hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during daylight hours (sunrise to sunset) and shall be collected regardless of the time of year, status of the construction site, or day of the week.

In conformance with the U.S. Environmental Protection Agency definition, a minimum of 72 hours of dry weather will be used to distinguish between separate rain events.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during the required inspections conducted before or during rain events:

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents storm water contact and runoff from the storage area.
- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not

cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

- An operational activity, including but not limited to those in Section 600.5.1, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) applicable BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.
- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.
- Storm water runoff from an area contaminated by historical usage of the site has been observed to combine with storm water runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

Sampling Locations

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use; accessibility for sampling, personnel safety; and other factors in accordance with the applicable requirements in the Caltrans *Guidance Manual: Stormwater Monitoring Protocols*. Planned sampling locations are shown on the WPCDs and include the following:

If the following is not "applicable", place cursor in a field and use the "Delete Line" option on the toolbar.

- [Enter number of locations] sampling locations have been identified for the collection of samples of runoff that drain areas where soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil will be applied.
- If applicable Sample location number(s) is located .
- [Enter number of locations] sampling locations have been identified for the collection of samples of runoff that drain areas contaminated by historical usage of the site.
- If applicable Sample location number(s) is located .
- [Enter number of locations] sampling locations have been identified for the collection of samples of run-on to the Caltrans right–of-way with the potential to combine with discharges being sampled for non-visible pollutants. These samples are intended to identify sources of potential non-visible pollutants that originate off the project site.
- If applicable Sample location number(s) is located .
- A location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants.

This location was selected such that the sample will not have come in contact with (1) operational or storage areas associated with the materials, wastes, and activities identified in Section 500.3.1; (2) potential non-visible pollutants due to historical use of the site as identified in Section 500.3.3; (3) areas in which soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied; or (4) disturbed soils areas.

- If applicable Sample location number(s) is located .

If an operational activity or storm water inspection conducted 24 hours prior to or during a rain event identifies the presence of a material storage, waste storage, or operations area with spills or the potential for the discharge of non-visible pollutants to surface waters or a storm sewer system that was an unplanned location and has not been identified on the WPCDs, sampling locations will be selected using the same rationale as that used to identify planned locations.

600.5.3 Monitoring Preparation

INSTRUCTIONS:

- Training of water quality sampling personnel shall be in accordance with the Caltrans *Guidance Manual: Stormwater Monitoring Protocols, Second Edition, July 2000*, CTSW-RT-00-005.
  - ❑ Identify whether samples will be collected by the contractor's personnel, by a commercial laboratory, or by an environmental consultant.
  - ❑ Identify training and experience of individuals responsible for collecting water samples
  - ❑ Identify the contractor's health and safety procedures for sampling personnel.
  - ❑ Identify alternate sampling personnel in case of emergency, sick leave, and/or vacations during storm water monitoring. Identify training of alternate sampling personnel.
  - ❑ Identify the state-certified laboratory(ies) that will analyze the samples. For a the list of California state-certified laboratories that are accepted by Caltrans, access the following web site: www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm
  - ❑ Include the appropriate required text to describe the strategy for ensuring that adequate sample collection supplies are available to the project in preparation for a sampling event.
  - ❑ Describe the strategy for ensuring that appropriate field-testing equipment is available to the project in preparation for a sampling event. If equipment is to be rented, contact a local environmental equipment rental company, such as www.totalsafetyinc.com.

REQUIRED TEXT if contractor personnel will collect samples:

Samples on the project site will be collected by the following contractor sampling personnel:

Name/Telephone Number:

Name/Telephone Number:

Alternate(s)/Telephone Number:

Alternate(s)/Telephone Number:

Prior to the rainy season, all sampling personnel and alternates will review the SAP. Qualifications of designated contractor personnel describing environmental sampling training and experience are provided in Attachment I.

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight. Sampling personnel with be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, surgical gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, Sampling Activity Log forms, and Chain of Custody (COC) forms.

The contractor will obtain and maintain the field-testing instruments, as identified in Section 600.5.6, for analyzing samples in the field by contractor sampling personnel.

Safety practices for sample collection will be in accordance with the [ENTER TITLE AND PUBLICATION DATE OF CONTRACTOR'S HEALTH AND SAFETY PLAN FOR THE PROJECT OR PROVIDE SPECIFIC REQUIREMENTS HEREIN].

REQUIRED TEXT if consultant or laboratory will collect samples:

Samples on the project site will be collected by the following [specify laboratory or environmental consultant]:

Company Name:
Address:

Telephone Number:
Point of Contact:

Qualifications of designated sampling personnel describing environmental sampling training and experience are provided in Attachment I.

WPCM will contact [specify name of laboratory or environmental consultant] [enter number of hours] hours prior to a predicted rain event and if one of the triggering conditions is identified during an inspection before, during, or after a storm event to ensure that adequate sample collection personnel, supplies and field test equipment for monitoring non-visible pollutants are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.

[Specify name of laboratory or environmental consultant] will obtain and maintain the field-testing instruments, as identified in Section 600.5.6, for analyzing samples in the field by their sampling personnel.

600.5.4 Analytical Constituents

INSTRUCTIONS:

- ❑ Identify the specific non-visible pollutants on the project site by completing Table 600-2, "Potential Non-Visible Pollutants and Water Quality Indicator Constituents" table.
- ❑ List the non-visible pollutant source, non-visible pollutant name, and water quality indicator
- ❑ Refer to the "Construction Material and Pollutant Testing Guidance Table - Non-Visible Pollutants" for a partial list of some of the common non-visible pollutants.
- ❑ Add lines to the table as needed.
- Do not include visible pollutants such as:
  - Petroleum products: gas, diesel, and lubricants
  - Colored paints
  - Sand, gravel or topsoil
  - Asphalt cold mix
- ❑ Fill in Table 600-3, Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

REQUIRED TEXT:

Identification of Non-Visible Pollutants

The following table lists the specific sources and types of potential non-visible pollutants on the project site and the applicable water quality indicator constituent(s) for that pollutant.

Table 600-2
Potential Non-Visible Pollutants and Water Quality Indicator Constituents

	Pollutant Source	Pollutant	Water Quality Indicator Constituent
Example:	Vehicle batteries	Lead, Sulfate, Acid.	Lead, sulfate or pH

600.5.5 Sample Collection and Handling

INSTRUCTIONS:

- For sampling collection procedures, refer to the *Caltrans Guidance Manual: Stormwater Monitoring Protocols* (Second Edition, July 2000) for general guidance.

- For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136.
- For a the list of California state-certified laboratories that are accepted by Caltrans, access the following web site: www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm
- A Chain of Custody (COC) form is required to be submitted to the laboratory with the samples to trace the possession and handling of samples from collection through analysis.
- A Sampling Activity Log is required to document details of all sampling events and to record results for samples analyzed in the field.
- Each sample bottle is required to have a proper and complete identification label.
- Run-on samples may be collected using the following collection procedures or others approved by the RE:

    - Place several rows of sand bags in a half circle directly in the path of the run-on to pond water and wait for enough water to spill over. Then place a decontaminated or clean flexible hose along the top and cover with another sandbag so that ponded water will only pour through the flexible hose and into sample bottles. Do not reuse the same sandbags in future sampling events as they may cross-contaminate future samples.
    - Place a decontaminated or clean dustpan with open handle in the path of the run-on so that water will pour through the handle and into sample bottles.
    - If not using clean equipment, decontaminate by washing equipment in a TSP-soapy water wash, distilled water rinse, and final rinse with distilled water.

- [ ] Describe sample collection procedures to be used on the project site.
- [ ] Describe sample-handling procedures.
- [ ] Describe decontamination waste disposal requirements (i.e., TSP soapy water shall not to be discharged to the storm drainage system or receiving water)
- [ ] Describe sample collection documentation procedures.
- [ ] Describe procedures for recording and correcting sampling data.
- [ ] Fill in Table 600-3, Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants, in Section 600.5.6.

REQUIRED TEXT:

Sample Collection Procedures

Samples of discharge will be collected at the designated sampling locations shown on the WPCDs for observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Grab samples will be collected and preserved in accordance with the methods identified in Table 600-3, “Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants” table provided in Section 600.5.6. Only personnel trained in proper water quality sampling will collect samples.

Samples will be collected by placing a separate lab-provided sample container directly into a stream of water downgradient and within close proximity to the potential non-visible pollutant discharge location. This separate lab-provided sample container will be used to collect water, which will be transferred to sample bottles for laboratory analysis. The upgradient and uncontaminated background samples shall be collected first prior to collecting the downgradient to minimize cross-contamination. The sampling personnel will collect the water upgradient of where they are standing. Once the separate lab-provided sample container is filled, the water sample will be poured directly into sample bottles provided by the laboratory for the analyte(s) being monitored.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Wear a clean pair of surgical gloves prior to the collection and handling of each sample at each location.
- Not contaminate the inside of the sample bottle by not allowing it to come into contact with any material other than the water sample.
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection.
- Not leave the cooler lid open for an extended period of time once samples are placed inside.
- Not sample near a running vehicle where exhaust fumes may impact the sample.
- Not touch the exposed end of a sampling tube, if applicable.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Not eat, smoke, or drink during sample collection.
- Not sneeze or cough in the direction of an open sample bottle.
- Minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample to take place.
- Decontaminate sampling equipment prior to sample collection using a TSP-soapy water wash, distilled water rinse, and final rinse with distilled water.
- Dispose of decontamination water/soaps appropriately; i.e., not discharge to the storm drain system or receiving water

Sample Handling Procedures

REQUIRED TEXT only If A laboratory will analyze ALL OR SOME OF THE samples:

Immediately following collection, sample bottles for laboratory analytical testing will be capped, labeled, documented on a Chain of Custody form provided by the analytical laboratory, sealed in a re-sealable storage bag, placed in an ice-chilled cooler, at as near to 4 degrees Celsius as practicable, and delivered within 24 hours to the following California state-certified laboratory:

Laboratory Name:
Address:

Telephone Number:
Point of Contact:

REQUIRED TEXT only If contractor will analyze <u>SOME OR ALL</u> samples:

Immediately following collection, samples for field analysis will be tested in accordance with the field instrument manufacturer's instructions and results recorded on the Sampling Activity Log.

REQUIRED TEXT:

<u>Sample Documentation Procedures</u>

All original data documented on sample bottle identification labels, Chain of Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated. Copies of the Chain of Custody form and Sampling Activity Log are provided in Attachment I.

Sampling and field analysis activities will be documented using the following:

- <u>Sample Bottle Identification Labels:</u> Sampling personnel will attach an identification label to each sample bottle. At a minimum, the following information will be recorded on the label, as appropriate:

  - Project name
  - Project number
  - Unique sample identification number and location.
    [Caltrans Number]-[Six digit sample collection date]-[Location]
    (*Example:* 07-0G5304-081801-Inlet472).
    Quality assurance/quality control (QA/QC) samples shall be identified similarly using a unique sample number or designation
    (*Example:* 07-0G5304-081801-DUP1).
    - Collection date/time (No time applied to QA/QC samples)
    - Analysis constituent

- <u>Sampling Activity Logs</u>: A log of sampling events will identify:

    - Sampling date
    - Separate times for collected samples and QA/QC samples recorded to the nearest minute
    - Unique sample identification number and location

- Analysis constituent
- Names of sampling personnel
- Weather conditions (including precipitation amount)
- Field analysis results
- Other pertinent data

- Chain of Custody (COC) forms: All samples to be analyzed by a laboratory will be accompanied by a COC form provided by the laboratory. Only the sample collectors will sign the COC form over to the lab. COC procedures will be strictly adhered to for QA/QC purposes.

- Storm Water Quality Construction Inspection Checklists: When applicable, the contractor's storm water inspector will document on the checklist that samples for non-visible pollutants were taken during a rain event.

600.5.6 Sample Analysis

INSTRUCTIONS:

- ❑ Identify the test method and specifications to be used to monitor the non-visible pollutants included in the "Potential Non-Visible Pollutants and Water Quality Indicator Constituents" table in Section 600.5.4.
- ❑ Fill in Table 600-3, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants".
- ❑ There should be a test method identified for each Water Quality Indicator Constituent listed in the table in Section 600.5.4.
- ❑ Contact the selected laboratory for the appropriate test method(s)/specifications to be used for each constituent.
- ❑ Identify field test instruments to be used for analyzing samples in the field, if any.

REQUIRED TEXT:

Samples will be analyzed for the applicable constituents using the analytical methods identified in Table 600-3, "Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants" table in this section.

Example:

TABLE 600-3 (Sample)

Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

Constituent	Analytical Method	Minimum Sample Volume	Sample Bottle	Sample Preservation	Reporting Limit	Maximum Holding Time
VOCs-Solvents	EPA 8260B	3 x 40 mL	VOA-glass	Store at 4˚ C, HCl to pH<2	1 µg/L	14 days
SVOCs	EPA 8270C	1 x 1 L	Glass-Amber	Store at 4˚ C	10 µg/L	7 days
Pesticides/PCBs	EPA 8081A/8082	1 x 1 L	Glass-Amber	Store at 4˚ C	0.1 µg/L	7 days
Herbicides	EPA 8151A	1 x 1 L	Glass-Amber	Store at 4˚ C	Check Lab	7 days
BOD	EPA 405.1	1 x 500 mL	Polypropylene	Store at 4˚ C	1 mg/L	48 hours
COD	EPA 410.4	1 x 250 mL	Glass-Amber	Store at 4˚ C, H_2SO_4 to pH<2	5 mg/L	28 days
DO	SM 4500-O G	1 x 250 mL	Glass-Amber	Store at 4˚ C	Check Lab	8 hours
pH	EPA 150.1	1 x 100 mL	Polypropylene	None	unitless	Immediate
Alkalinity	SM 2320B	1 x 250 mL	Polypropylene	Store at 4˚ C	1 mg/L	14 days
Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Na, Th, Va, Zn)	EPA 6010B/7470A	1 x 250 mL	Polypropylene	Store at 4˚ C, HNO_3 to pH<2	0.1 mg/L	6 months
Metals (Chromium VI)	EPA 7199	1 x 500 mL	Polypropylene	Store at 4˚ C	.1□g/L	24 hours

Notes:
- °C – Degrees Celsius
- BOD – Biological Oxygen Demand
- COD – Chemical Oxygen Demand
- DO – Dissolved Oxygen
- EPA – Environmental Protection Agency
- HCl – Hydrogen Chloride
- H_2SO_4 – Hydrogen Sulfide
- HNO_3 – Nitric Acid
- L – Liter
- mg/L – Milligrams per Liter
- µg/L – Micrograms per Liter
- mL – Milliliter
- PCB – Polychlorinated Biphenyl
- SVOC – Semi-Volatile Organic Compound
- SM – Standard Method
- TPH – Total Petroleum Hydrocarbons
- TRPH – Total Recoverable Petroleum Hydrocarbons
- VOA – Volatile Organic Analysis
- VOC – Volatile Organic Compound

REQUIRED TEXT:

TABLE 600-3

Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

Constituent	Analytical Method	Minimum Sample Volume	Sample Bottle	Sample Preservation	Reporting Limit	Maximum Holding Time
Notes:						

REQUIRED TEXT only If samples will be analyzed in the field:

For samples collected for field analysis, collection, analysis and equipment calibration will be in accordance with the field instrument manufacturer's specifications.

The following field instrument(s) will be used to analyze the following constituents:

Field Instrument	Constituent

- The instrument(s) will be maintained in accordance with manufacturer's instructions.
- The instrument(s) will be calibrated before each sampling and analysis event.
- Maintenance and calibration records will be maintained with the SWPPP.

600.5.7 Quality Assurance/Quality Control

REQUIRED TEXT:

For an initial verification of laboratory or field analysis, duplicate samples will be collected at a rate of 10 percent or 1 duplicate per sampling event. The duplicate sample will be collected, handled, and analyzed using the same protocols as primary samples. A duplicate sample will be collected at each location immediately after the primary sample has been collected. Duplicates will be collected where contamination is likely, not on the background sample. Duplicate samples will not influence any evaluations or conclusions; however, they will be used as a check on laboratory quality assurance.

600.5.8 Data Management and Reporting

INSTRUCTIONS:

- ❑ Electronic data results shall be provided to the RE, unless he/she provides the name, company and e-mail address of the person to whom the data should be submitted.

REQUIRED TEXT:

A copy of all water quality analytical results and QA/QC data will be submitted to the Resident Engineer within 5 days of sampling (for field analyses) and within 30 days (for laboratory analyses).

Electronic results will be submitted on diskette in Microsoft Excel (.xls) format, and will include, at a minimum, the following information from the lab: Sample ID Number, Contract Number, Constituent, Reported Value, Lab Name, Method Reference, Method Number, Method Detection Limit, and Reported Detection Limit. Electronic data shall be reported in a format consistent with Caltrans *Water Quality Data Reporting Protocol* dated October 2001.

Lab reports and COCs will be reviewed for consistency between lab methods, sample identifications, dates, and times for both primary samples and QA/QC samples. All data, including COC forms and Sampling Activity Logs, shall be kept with the SWPPP document.

Electronic results will be emailed to [NAME] of [COMPANY] at [e-mail address] after final sample results are received after each sampling event for inclusion into a statewide database.

600.5.9 Data Evaluation

INSTRUCTIONS:

- The General Permit requires that BMPs be implemented on the construction site to reduce non-visible pollutants in discharges of storm water from the construction site.
- The runoff/downgradient water quality sample analytical results will be evaluated to determine if the runoff/downgradient sample(s) show significantly elevated concentrations of the tested analyte relative to the concentrations found in the uncontaminated background sample.
- The water quality sample analytical results will be evaluated to determine if the runoff and run-on samples show significantly elevated levels of the tested constituent relative to the levels found in the background sample. The run-on sample analytical results will be used as an aid in evaluating potential offsite influences on water quality results.

REQUIRED TEXT:

An evaluation of the water quality sample analytical results, including figures with sample locations, will be submitted to the Resident Engineer with the water quality analytical results and the QA/QC data.

Should the runoff/downgradient sample show an increased level of the tested analyte relative to the background sample, the BMPs, site conditions, and surrounding influences will be assessed to determine the probable cause for the increase. As determined by the site and data evaluation, appropriate BMPs will be repaired or modified to mitigate discharges of non-visual pollutant concentrations. Any revisions to the BMPs will be recorded as an amendment to the SWPPP.

600.5.10 Change of Conditions

REQUIRED TEXT:

Whenever SWPPP monitoring, pursuant to Section B of the General Permit, indicates a change in site conditions that might affect the appropriateness of sampling locations or introduce additional non-visible pollutants of concern, testing protocols will be revised accordingly. All such revisions will be recorded as amendments to the SWPPP.

Appendix C

Weather Tracking

This appendix discusses California meteorology and available weather tracking services in the state (i.e., forecasting services used by other stormwater monitoring programs).

California weather is generally characterized by a wet season (late fall through early spring) and an extended dry season (late spring through early fall). However, annual average rainfall ranges from less than five inches in desert areas of southeastern California to over 40 inches in northern coastal areas. Valley and coastal areas receive virtually all of their precipitation as rainfall and rarely receive snow, while mountainous areas typically experience abundant snowfall, particularly at higher elevations.

The vast majority of storm systems approach California from the Pacific Ocean. Storm tracks tend to follow the jet stream, a high altitude, high speed wind current, which moves generally from west to east around the globe. The most common storm track for weather approaching California begins with low-pressure systems that originate in the Gulf of Alaska, and follow the polar jet as it bends southeasterly towards the California coast. These systems tend to be relatively cold and produce snowfall at relatively low elevations. Also common are storm systems that form in the Pacific Ocean to the west/southwest of California, and follow the subtropical jet stream as it runs northeasterly towards California. These storms tend to be warmer, with a higher snow line.

The National Weather Service (NWS), a federal agency, and private weather forecasting contract services provide weather information. National Weather Service is a primary source of weather information for public and private sector forecasters. NWS collects and processes satellite imagery and other atmospheric data, and runs the major weather forecast models. Models are available for near term (1-2 days), medium range (3-5 days) and long range forecasting. Model reliability and specificity decline with extended time periods. The model output can be used to indicate potential candidate monitoring events up to one week in advance; however, at that time interval the model predictions are useful only as a rough indication of the likelihood of a precipitation event. The forecasters at NWS, as well as private contractor forecasters and news media (television) forecasters, use the model outputs together with other meteorological data (satellite and radar imagery, water vapor/atmospheric pressure/temperature data, etc.) to make their predictions. The NWS makes its forecast predictions available to the public.

The NWS forecasts are produced every twelve hours (at approximately 3:00 a.m. and p.m.), along with a written discussion of model output and weather observations. These discussions are meant for a professional meteorological audience, and are highly abbreviated and cryptic, but often provide insight into the basis for the published forecast. Private weather forecast services can be found by looking in the yellow pages of major city telephone books. Most private forecast services provide semi-weekly written forecasts, and 24-hour availability for telephone consultation.

The following is a partial list of contacts for weather forecasts for California:

1. National Weather Service (NWS) for western U.S. (http://www.wrh.noaa.gov/). Use the site to locate local forecasts (short term, long term, timing, and amounts).

2. The Weather Channel: local weather and radar imagery on cable TV, the "eights" of every hour or at its Web site (http://www.weather.com/).

3. Intellicast (http://www.intellicast.com), good for radar imagery only. Use the site to locate local forecasts.

4. Weather Underground (http://www.wunderground.com). Use the site to locate local forecasts.

5. Private Forecasting Services:

    a. Weathernews Americas, Inc. (www.us.weathernews.com).

    b. Weather Watch Service (www.weatherwatchservice.com).

    c. Qwikcast (www.qwikcast.com).

6. Local News (TV stations and associated web sites).

7. Local Newspapers (and associated web sites).

Appendix D

Bottle and Equipment Cleaning Protocols

SAMPLE BOTTLES

1. Rinse bottle with warm tap water three times as soon as possible after emptying sample.
2. Soak in a 2% Contrad solution for 48 hours; scrub with clean plastic brush.
3. Rinse three times with tap water.
4. Rinse five times with Milli-Q water, rotating the bottle to ensure contact with the entire inside surface.
5. Rinse three times with hexane, rotating the bottle to ensure contact with the entire inside surface (use 30 ml per rinse).
6. Rinse six times with Milli-Q water.
7. Rinse three times with 2N nitric acid (1 liter per bottle, per rinse) rotating the bottle to ensure contact with the entire inside surface.
8. Rinse six times with Milli-Q water.
9. Cap bottle with Teflon lined lid cleaned as specified below.

LIDS

1. Make up a 2% solution of Micro soap in warm tap water.
2. Rinse tubing three times with the 2% Micro Solution, wash lids.
3. Rinse three times with tap water.
4. Rinse three times with Milli-Q water.
5. Rinse three times with a 2N nitric acid solution.
6. Soak 24 hours in a 2N nitric acid solution.
7. Rinse three times with Milli-Q water.

CLEANING SOLUTIONS

- 2% Contrad = 200 ml concentrated Contrad per full 10L bottle
- 2% HNO3 Acid = 80 ml concentrated HNO3 acid (16N) per gallon of Milli-Q water
- 2% Micro = 80 ml concentrated Micro per gallon of Milli-Q water

EQUIPMENT AND HANDLING

1. Safety Precautions - All of the appropriate safety equipment must be worn by personnel involved in the cleaning of the bottles due to the corrosive nature of the chemicals being used to clean the bottles and tubing. This safety equipment must include protective gloves, lab coats, chemically resistant aprons, goggles with side shields and respirators. All MSDS must be read and signed off by personnel.

2. A record book must be kept of each sample bottle washed, outlining the day the bottle was cleaned and checked off for passage of the quality control check.

3. Nitrile gloves must be worn while cleaning and handling bottles and equipment. Care must be taken at all times to avoid introduction of contamination from any source.

Appendix E

Data Screening and Validation Protocols

All data reported by the analytical laboratory must be carefully reviewed to determine whether the project's data quality acceptability limits or objectives (DQOs) have been met. This section describes a process for evaluation of all laboratory data, including the results of all QA/QC sample analysis.

Before the laboratory reports any results, the deliverable requirements should be clearly communicated to the laboratory.

The current section discusses QA/QC data evaluation in the following two parts:

- Initial Data Quality Screening
- Data Quality Evaluation

The initial data quality screening identifies problems with laboratory reporting while they may still be corrected. When the data reports are received, they should be immediately checked for conformity to chain of custody requests to ensure that all requested analyses have been reported. The data are then evaluated for conformity to holding time requirements, conformity to reporting limit requests, analytical precision, analytical accuracy, and possible contamination during sampling and analysis. The data evaluation results in rejection, qualification, and narrative discussion of data points or the data as a whole. Qualification of data, other than rejection, does not necessary exclude use of the data for all applications. It is the decision of the data user, based on specifics of the data application, whether or not to include qualified data points.

INITIAL DATA QUALITY SCREENING

The initial screening process identifies and corrects, when possible, inadvertent documentation or process errors introduced by the field crew or the laboratory. The initial data quality control screening should be applied using the following three-step process:

1. *Verification check between sampling and analysis plan (SAP), chain of custody forms, and laboratory data reports*: Chain of custody records should be compared with field logbooks and laboratory data reports to verify the accuracy of all sample identification and to ensure that all samples submitted for analysis have a value reported for each parameter requested. Any deviation from the SAP that has not yet been documented in the field notes or project records should be recorded and corrected if possible.

   Sample representativeness should also be assessed in this step. Samples not meeting the criteria are generally not analyzed; however, selected analyses can be run at the Caltrans task manager's discretion. If samples not meeting the minimum sample representativeness criteria are analyzed, the resulting data should be rejected ("R") or qualified as estimated ("J"), depending upon whether the analyses were approved by Caltrans. Grab samples should be taken according to the timing protocols specified in the SAP. Deviations from the protocols will result in the rejection of the data for these samples or qualification of the data as estimated. The decision to reject a sample based on sample representativeness should be made prior to the submission of the sample to the laboratory, to avoid unnecessary analytical costs.

2. *Check of laboratory data report completeness*: The end product of the laboratory analysis is a data report that should include a number of QA/QC results along with the environmental results. QA/QC sample results reported by the lab should include both analyses requested by the field crew (field blanks, field duplicates, lab duplicates and MS/MSD analysis), as well as internal laboratory QA/QC results (method blanks and laboratory control samples). There are often differences among laboratories in terms of style and format of reporting. Therefore, it is prudent to request in advance that the laboratory conform to the style and format approved by Caltrans. The Caltrans data reviewer should verify that the laboratory data package includes the following items:

    - ✓ A narrative which outlines any problems, corrections, anomalies, and conclusions
    - ✓ Sample identification numbers
    - ✓ Sample extraction and analysis dates
    - ✓ Reporting limits for all analyses reported
    - ✓ Results of method blanks
    - ✓ Results of matrix spike and matrix spike duplicate analyses, including calculation of percent recovered and relative percent differences
    - ✓ Results of laboratory control sample analyses
    - ✓ Results of external reference standard analyses
    - ✓ Surrogate spike and blank spike analysis results for organic constituents.
    - ✓ A summary of acceptable QA/QC criteria (RPD, spike recovery) used by the laboratory

    Items missing from this list should be requested from the laboratory.

3. *Check for typographical errors and apparent incongruities*: The laboratory reports should be reviewed to identify results that are outside the range of normally observed values. Any type of suspect result or apparent typographical error should be verified with the laboratory. An example of a unique value would be if a dissolved iron concentration has been reported lower than 500 µg/L for every storm event monitored at one location and then a value of 2500 µg/L is reported in a later event. This reported concentration of 2500 µg/L should be verified with the laboratory for correctness. Besides apparent out-of-range values, the indicators of potential laboratory reporting problems include:

- Significant lack of agreement between analytical results reported for laboratory duplicates or field duplicates
- Consistent reporting of dissolved metals results higher than total or total recoverable metals.
- Unusual numbers of detected values reported for blank sample analyses.
- Inconsistency in sample identification/labeling.

If the laboratory confirms a problem with the reported concentration, the corrected or recalculated result should be issued in an amended report, or if necessary the sample should be re-analyzed. If laboratory results are changed or the laboratory makes other corrections, an amended laboratory report should be issued to update the project records.

DATA QUALITY EVALUATION

The data quality evaluation process is structured to provide systematic checks to ensure that the reported data accurately represent the concentrations of constituents actually present in stormwater. Data evaluation can often identify sources of contamination in the sampling and analytical processes, as well as detect deficiencies in the laboratory analyses or errors in data reporting. Data quality evaluation allows monitoring data to be used in the proper context with the appropriate level of confidence.

QA/QC parameters that should be reviewed are classified into the following categories:

- ✓ Reporting limits
- ✓ Holding times
- ✓ Contamination check results (method, field, trip, and equipment blanks)
- ✓ Precision analysis results (laboratory, field, and matrix spike duplicates)
- ✓ Accuracy analysis results (matrix spikes, surrogate spikes, laboratory control samples, and external reference standards)

Each of these QA/QC parameters should be compared to data quality acceptability criteria, in also known as the project's data quality objectives (DQOs). The key steps that should be adhered to in the analyses of each of these QA/QC parameters are:

1. Compile a complete set of the QA/QC results for the parameter being analyzed.
2. Compare the laboratory QA/QC results to accepted criteria (DQOs).
3. Compile any out-of-range values and report them to the laboratory for verification.
4. Prepare a report that tabulates the success rate for each QA/QC parameter analyzed.

This process should be applied to each of the QA/QC parameters as discussed below.

Reporting Limits

Storm water quality monitoring program DQOs should contain a list of acceptable reporting limits that the lab is contractually obligated to adhere to, except in special cases of insufficient sample volume or matrix interference problems. The reporting limits used should ensure a high probability of detection.

Holding Times

Holding time represents the elapsed time between sample collection time and sample analysis time. Calculate the elapsed time between the sampling time and start of analysis, and compare this to the required holding time. It is important to review sample holding times to ensure that analyses occurred within the time period that is generally accepted to maintain stable parameter concentrations. If holding times are exceeded, inaccurate concentrations or false negative results may be reported. Samples that exceed their holding time prior to analysis are qualified as “estimated”, or may be rejected depending on the circumstances.

Contamination

Blank samples are used to identify the presence and potential source of sample contamination and are typically one of four types:

1. *Method blanks* are prepared and analyzed by the laboratory to identify laboratory contamination.
2. *Field blanks* are prepared by the field crew during sampling events and submitted to the laboratory to identify contamination occurring during the collection or the transport of environmental samples.
3. *Equipment blanks* are prepared by the field crew or laboratory prior to the monitoring season and used to identify contamination coming from sampling equipment (tubing, pumps, bailers, etc.).
4. *Trip blanks* are prepared by the laboratory, carried in the field, and then submitted to the laboratory to identify contamination in the transport and handling of volatile organics samples.
5. *Filter blanks* are prepared by field crew or lab technicians performing the sample filtration. Blank water is filtered in the same manner and at the same time as other environmental samples. Filter blanks are used to identify contamination from the filter or filtering process.

If no contamination is present, all blanks should be reported as “not detected” or “nondetect” (e.g., constituent concentrations should not be detected above the reporting limit). Blanks reporting detected concentrations (“hits”) should be noted in the written

QA/QC data summary prepared by the data reviewer. In the case that the laboratory reports hits on method blanks, a detailed review of raw laboratory data and procedures should be requested from the laboratory to identify any data reporting errors or contamination sources. When other types of blanks are reported above the reporting limit, a similar review should be requested along with a complete review of field procedures and sample handling. Often times it will also be necessary to refer to historical equipment blank results, corresponding method blank results, and field notes to identify contamination sources. This is a corrective and documentative step that should be done as soon as the hits are reported.

If the blank concentration exceeds the laboratory-reporting limit, values reported for each associated environmental sample must be evaluated according to USEPA guidelines for data evaluations of organics and metals (USEPA, 1991; USEPA, 1995) as indicated in Table 13-1.

Table E-1. USEPA Guidelines for Data Evaluation

Step	***Environmental Sample***	***Phthalates and Other Common Contaminants***	***Other Organics***	***Metals***
1.	Sample > 10X blank concentration	No action	No action	No action
2.	Sample < 10X blank concentration	Report associated environmental results as “nondetect” at the reported environmental concentration.	No action	Results considered an “upper limit” of the true concentration (note contamination in data quality evaluation narrative).
3.	Sample < 5X blank concentration	Report associated environmental results as “nondetect” at the reported environmental concentration.	Report associated environmental results as “nondetect” at the reported environmental concentration.	Report associated environmental results as “nondetect” at the reported environmental concentration.

Specifically, if the concentration in the environmental sample is less than five times the concentration in the associated blank, the environmental sample result is considered, for reporting purposes, “not-detected” *at the environmental sample result concentration* (phthalate and other common contaminant results are considered non-detect if the environmental sample result is less than ten times the blank concentration). The laboratory reports are not altered in any way. The qualifications resulting from the data evaluation are made to the evaluator’s data set for reporting and analysis purposes to account for the apparent contamination problem. For example, if dissolved copper is reported by the laboratory at 4 µg/L and an associated blank concentration for dissolved copper is reported at 1 µg/L, data qualification would be necessary. In the data reporting field of the database, the dissolved copper result would be reported as 4 µg/L), the numerical qualifier would be reported as “<”, the reporting limit would be left as reported by the laboratory, and the value qualifier would be reported as “U” (“not detected above the reported environmental concentration”).

When reported environmental concentrations are greater than five times (ten times for phthalates) the reported blank “hit” concentration, the environmental result is reported unqualified at the laboratory-reported concentration. For example, if dissolved copper is reported at 11 µg/L and an associated blank concentration for dissolved copper is reported at 1 µg/L, the dissolved copper result would still be reported as 11 µg/L.

Precision

Duplicate samples provide a measure of the data precision (reproducibility) attributable to sampling and analytical procedures. Precision can be calculated as the relative percent difference (RPD) in the following manner:

$$RPD_i = \frac{2\,x\left|O_i - D_i\right|}{(Q_i + D_i)}\,x\,100\%$$

where:

RPDi = Relative percent difference for compound I

Oi = Value of compound i in original sample

Di = Value of compound i in duplicate sample

The resultant RPDs should be compared to the criteria specified in the project's DQOs. The DQO criteria shown in Table 13-2 below are based on the analytical method specifications and laboratory-supplied values. Project-specific DQOs should be developed with consideration to the analytical laboratory, the analytical method specifications, and the project objective. Table 13-2 should be used as a reference point as the least stringent set of DQO criteria for Caltrans monitoring projects.

<u>Laboratory and Field Duplicates</u>

Laboratory duplicates are samples that are split by the laboratory. Each half of the split sample is then analyzed and reported by the laboratory. A pair of field duplicates is two samples taken at the same time, in the same manner into two unique containers. Laboratory duplicate results provide information regarding the variability inherent in the analytical process, and the reproducibility of analytical results. Field duplicate analysis measures both field and laboratory precision, therefore, it is expected that field duplicate results would exhibit greater variability than lab duplicate results.

The RPDs resulting from analysis of both laboratory and field duplicates should be reviewed during data evaluation. Deviations from the specified limits, and the effect on reported data, should be noted and commented upon by the data reviewer. Laboratories typically have their own set of maximum allowable RPDs for laboratory duplicates based on their analytical history. In most cases these values are more stringent than those listed in Table 13-2. Note that the laboratory will only apply these maximum allowable RPDs to laboratory duplicates. In most cases field duplicates are submitted "blind" (with pseudonyms) to the laboratory.

Table E-2 Typical Control Limits for Precision and Accuracy for Water Samples

Constituent	EPA Method	Maximum RPD	Recovery Lower Limit	Recovery Upper Limit
Conventionals				
Conductivity	120.1	20%	NA	NA
Hardness	130.2; 130.1; SM 2340B	20%	80%	120%
pH	150.1	20%	NA	NA
TDS	160.1	20%	80%	120%
TSS	160.2	20%	80%	120%
Turbidity	180.1	20%	NA	NA
BOD	405.1; SM5210B			
COD	410.1/4; SM 5220C/D	20%	80%	120%
TOC/DOC	415.1	15%	85%	115%
Nutrients				
NO_3-N	300.0	20%	80%	120%
NO_2-N	300.0	20%	80%	120%
NH_3-N	350.2; 350.3	20%	80%	120%
TKN	351.3	20%	80%	120%
Phosphorus	365.3	20%	80%	120%
Ortho-phosphate	365.2	20%	80%	120%
Metals				
Aluminum (Al)	200.8	20%	75%	125%
Arsenic (As)	206.3	20%	75%	125%
Cadmium (Cd)	200.8	20%	75%	125%
Chromium (Cr)	200.8	20%	75%	125%
Copper (Cu)	200.8	20%	75%	125%
Iron (Fe)	200.9	20%	75%	125%
Lead (Pb)	200.8	20%	75%	125%
Nickel (Pb)	200.8	20%	75%	125%
Zinc (Zn)	200.8	20%	75%	125%
Silver (Ag)	200.8	20%	75%	125%
Selenium (Se)	200.8	20%	75%	125%
Mercury (Hg)	1631	21%	79%	121%
Total Petroleum Hydrocarbons				
TPH (gasoline)	8015b	21%	45%	129%
TPH (diesel)	8015b	21%	45%	129%
TPH (motor oil)	8015b	21%	45%	129%
Oil & Grease	1664	18%	79%	114%
Pesticides and Herbicides				
Glyphosate	547	30%	70%	130%
OP Pesticides (esp. diazinon and chlorpyrifos)	8141; ELISA	25%	See method for constituent specific	
OC Pesticides	8081	25%		
Chlorinated Herbicides	8150; 8151	25%		
Carbamate Pesticides	8321	25%		
Miscellaneous Organic Constituents				
Base/Neutrals and Acids	625; 8270	30% to 50%	See method for constituent specific	
PAHs	8310			
Purgeables	624; 8260	20%		
Purgeable Halocarbons	601	30%		
Purgeable Aromatics	602	20%		
Miscellaneous Constituents				
Cyanide	335.2	20%	75%	125%
Bacteriological				
Fecal Coliform	SM 9221E	NA	NA	NA
Total Coliform	SM 9221B	NA	NA	NA

Notes: RPD = relative percent difference between duplicate analyses.
Recovery, lower and upper limits refer to analysis of spiked samples.

Environmental samples associated with laboratory duplicate results greater than the maximum allowable RPD (when the numerical difference is greater than the reporting limit) are qualified as “J” (estimated). When the numerical difference is less than the RL, no qualification is necessary. Field duplicate RPDs are compared against the maximum allowable RPDs used for laboratory duplicates to identify any pattern of problems with reproducibility of results. Any significant pattern of RPD exceedances for field duplicates should be noted in the data report narrative.

Corrective action should be taken to address field or laboratory procedures that are introducing the imprecision of results. The data reviewer can apply "J" (estimated) qualifiers to any data points if there is clear evidence of a field or laboratory bias issue that is not related to contamination. (Qualification based on contamination is assessed with blank samples.)

Laboratories should provide justification for any laboratory duplicate samples with RPDs greater than the maximum allowable value. In some cases, the laboratory will track and document such exceedances, however; in most cases it is the job of the data reviewer to locate these out-of-range RPDs. When asked to justify excessive RPD values for field duplicates, laboratories most often will cite sample-splitting problems in the field.
Irregularities should be included in the data reviewer's summary, and the laboratory's response should be retained to document laboratory performance, and to track potential chronic problems with laboratory analysis and reporting.

Accuracy

Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. Accuracy is measured as the percent recovery (%R) of spike compound(s).

Percent recovery of spikes is calculated in the following manner:

$$\%R = 100\% * [(Cs - C) / S]$$

where:

%R = percent recovery

Cs = spiked sample concentration

C = sample concentration for spiked matrices

S = concentration equivalent of spike added

Accuracy (%R) criteria for spike recoveries should be compared with the limits specified in the project DQOs. A list of typical acceptable recoveries is shown in Table 13-2. As in the case of maximum allowable RPDs, laboratories develop acceptable criteria for an allowable range of recovery percentages that may differ from the values listed in Table 13-2.

Percent recoveries should be reviewed during data evaluation, and deviations from the specified limits should be noted in the data reviewer's summary. Justification for out of range recoveries should be provided by the laboratory along with the laboratory reports, or in response to the data reviewer's summary.

Laboratory Matrix Spike and Matrix Spike Duplicate Samples

Evaluation of analytical accuracy and precision in environmental sample matrices is obtained through the analysis of laboratory matrix spike (MS) and matrix spike duplicate
(MSD) samples. A matrix spike is an environmental sample that is spiked with a known amount of the constituent being analyzed. A percent recovery can be calculated from the results of the spike analysis. A MSD is a duplicate of this analysis that is performed as a check on matrix recovery precision. MS and MSD results are used together to calculate RPD as with the duplicate samples. When MS/MSD results (%R and RPD) are outside the project specifications, as listed in Table 13-2, the associated environmental samples are qualified as "estimates due to matrix interference". Surrogate standards are added to all environmental and QC samples tested by gas chromatography (GC) or gas chromatography-mass spectroscopy (GC-MS). Surrogates are non-target compounds that are analytically similar to the analytes of interest. The surrogate compounds are spiked into the sample prior to the extraction or analysis. Surrogate recoveries are evaluated with respect to the laboratory acceptance criteria to provide information on the extraction efficiency of every sample.

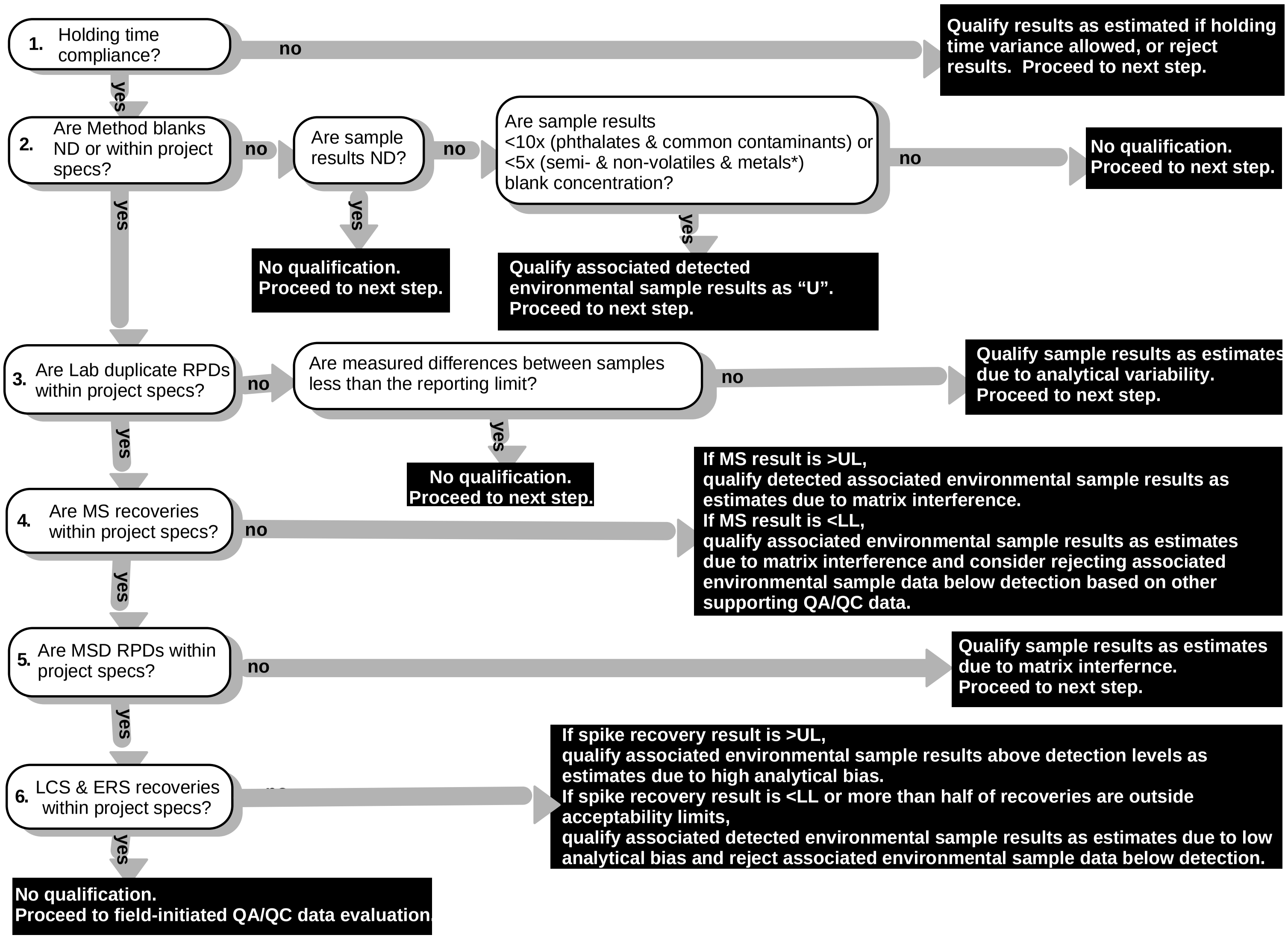
External Reference Standards

External reference standards (ERS) are artificial certified standards prepared by an external agency and added to a batch of samples. ERS's are not required for every batch of samples, and are often only run quarterly by laboratories. Some laboratories use ERS's in place of laboratory control spikes with every batch of samples. ERS results are assessed the same as laboratory control spikes for qualification purposes (see below). The external reference standards are evaluated in terms of accuracy, expressed as the percent recovery (comparison of the laboratory results with the certified concentrations). The laboratory should report all out-of-range values along with the environmental sample results. ERS values are qualified as biased high" when the ERS recovery exceeds the acceptable recovery range and "biased low" when the ERS recovery is smaller than the recovery range.

Laboratory Control Samples

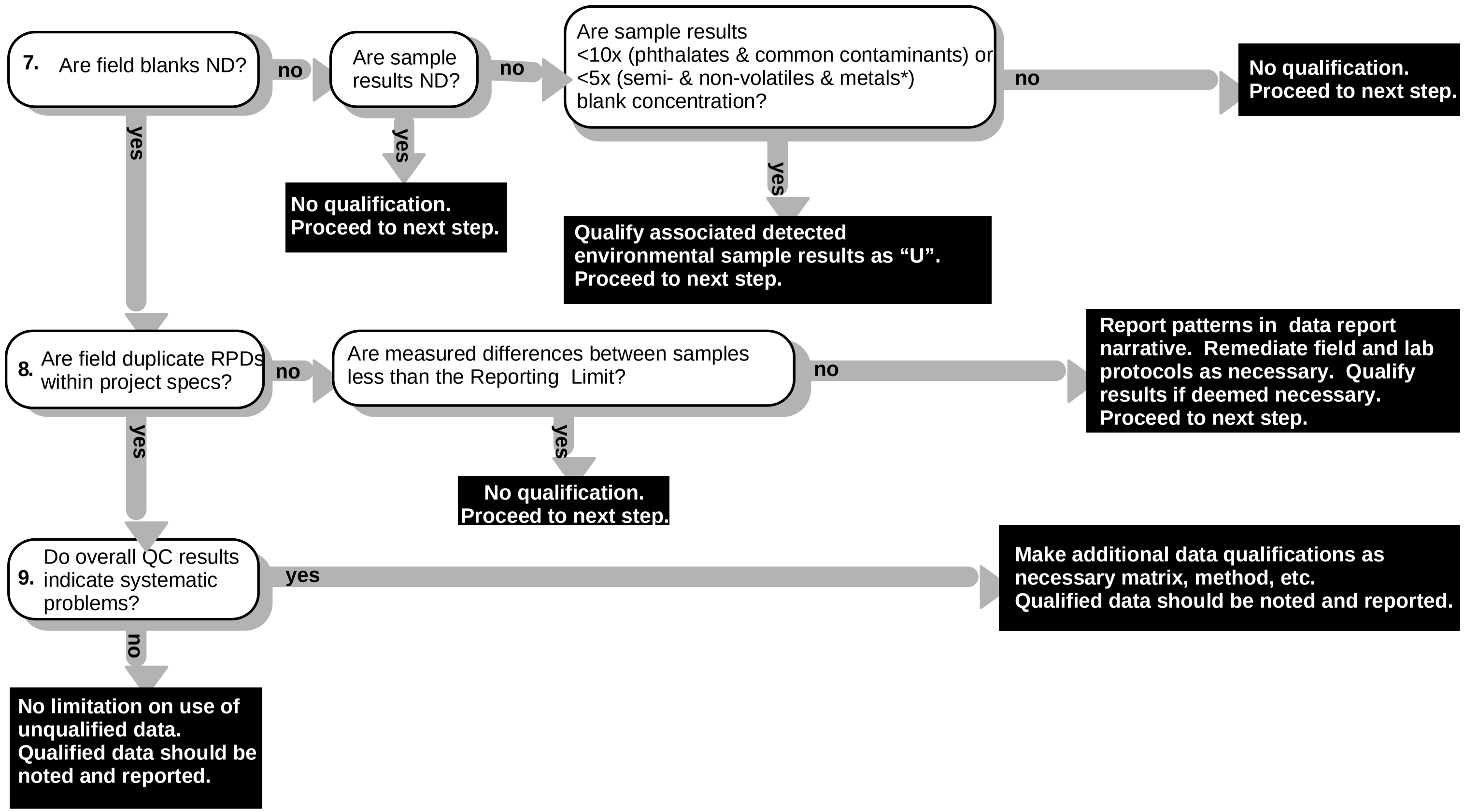
LCS analysis is another batch check of recovery of a known standard solution that is used to assess the accuracy of the entire recovery process. LCSs are much like ERS's except that a certified standard is not necessarily used with LCSs, and the laboratory prepares the sample internally so the cost associated with preparing a LCS sample is much lower than the cost of ERS preparation. LCSs are reviewed for percent recovery within control limits provided by the laboratory. LCS out-of-range values are treated in the same manner as ERS out-of-range values. Because LCS and ERS analysis both check the entire recovery process, any irregularity in these results supersedes other accuracy-related qualification. Data are rejected due to low LCS recoveries when the associated environmental result is below the reporting limit.

A flow chart of the data evaluation process, presented on the following pages as Figures E-1 (lab-initiated QA/QC samples) and E-2 (field-initiated QA/QC), can be used as a general guideline for data evaluation. Boxes shaded black in Figures E-1 and E-2 designates final results of the QA/QC evaluation.



*Environmental results between 5x and 10x the blank concentration are qualified as "an upper limit on the true concentration" and the data user should be cautioned.

Figure E-1. Technical Data Evaluation for Lab-Initiated QA/QC Samples



*Environmental results between 5x and 10x the blank concentration are qualified as "an upper limit on the true concentration" and the data user should be cautioned.

Figure E-2. Technical Data Evaluation for Field-Initiated QA/QC Samples